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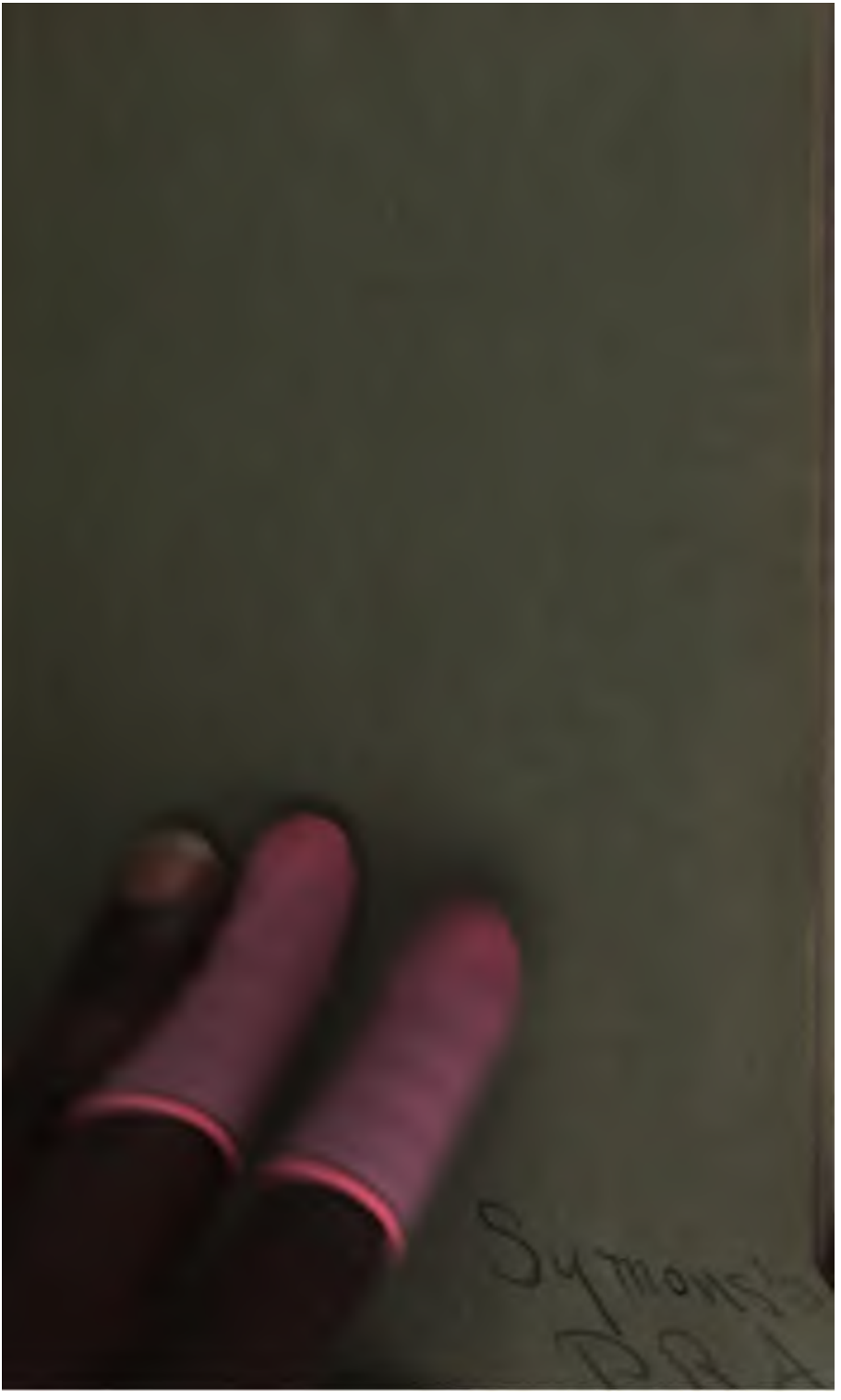

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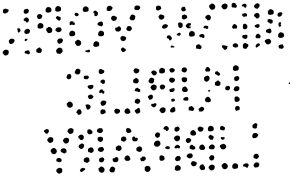

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ERRATUM.

On pp. 164, 165, the date in the headline should have been *Octocer* 20th not *October* 11th.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

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SYMONS'S
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THE JANUARY FROST.

THE very highest compliment which readers can pay to a book or periodical, is to show that they read it. We are very glad to say that that compliment seems to be always paid to the *Meteorological Magazine*, because when the Editor makes a mistake—as everyone does more or less frequently—he hears of it instanter. We had not studied exhaustively the frost of January 5th to 7th, in fact the majority of the records had not reached us, but we did what time permitted, and gave various facts, which are not contested; but we concluded with an opinion which was incorrect; we said, "we do not think that the air temperature fell to zero in any part of England." The excellence of the instruments employed by Mr. Mellish, of Hodsock Priory, Worksop, and his careful reading of them are beyond all question, and he had —4°·4, and several other indisputable records below zero have now been received.

However, our error and the criticism of it, have perhaps done good: they have induced us to go thoroughly into the subject, to tabulate several hundred records, and to epitomize them in the following pages.

Before dealing with them, or allowing our readers to draw conclusions from them, we wish to say a few words as to low temperatures and why we always doubt them—yes, doubt even our own readings so much that we take them in duplicate.

Unfortunately the only really workable mercurial minimum thermometer (Casella's) is extremely difficult to make, and therefore costly; consequently even at the best equipped stations, Rutherford's, or as it is generally called, a "spirit minimum" is used. This, no matter how much may have been paid for it, or what certificate it may have, can indicate wrongly from two causes (1) some of the spirit may evaporate from the column and condense at the top of the tube; and unfortunately, even though the spirit in the bulb and stem may be coloured, that which will evaporate and condense may be nearly colourless. Spirit thermometers vary in their liability to this error, but they should always be suspected of it and two or three precautions should be taken to ensure its detection; it is an excellent plan to have duplicate instruments, as the two are not likely to go simultaneously wrong to an equal extent; it is well to see that at

9 a.m. the reading (not the index) of the minimum, is nearly the same as that of the dry bulb thermometer; it is well to look at the top of the tube and see that no spirit is there. This error, when it exists, always makes the minima too low. It is easily cured by swinging the thermometer at arm's length, bulb downwards, and then standing it for an hour, bulb down, to drain.

Another error also tends to produce too low a reading. It is usual, and probably right, to advise that the bulb end of a minimum should be rather ($\frac{1}{2}$ inch or so) lower than the other end; provided that the thermometer and the screen be firmly fixed, no harm occurs. If, however, the thermometer hangs very freely, or the thermometer screen vibrates much, the repeated slight vibrations will sometimes cause the index to move several degrees towards the bulb.

These are dangers incident to high class stations—these *and others* may occur to ordinary observers. Uninspected stations may have incorrect thermometers; as the errors are equally likely to be in excess or in defect, we can say only that the sooner persons realize that their time and thought are worth more than the few shillings they keep—not *save*—by buying rubbish, the better.

Worse than this is the confusion which arises from the endless variety of positions in which thermometers are placed. At a first-class station, there are at least two minimum thermometers, one (for recording the lowest temperature of the air) is in a Stevenson screen, the other (for recording the lowest temperature produced by radiation) is laid upon grass—and this will read on a cloudy night much the same as the one in the screen, and on a clear night 10° or more degrees below it. The non-inspected stations rarely have a proper screen; the thermometers are against a window or a wall, or on a post, 1, 2, 3, or perhaps 4 feet above the ground, and very rarely screened from radiation to the sky, therefore, as a rule, they in times of severe frost, read too low; read in fact as their positions necessitate *between* the true minimum in air and the true minimum on grass.

It was consciousness of these facts, coupled with our not having seen zero recorded at any inspected station which led us into error.

In the following table we give all the minima below 10° which we have been able to collect, and as a rule they are sufficiently accordant to show that our criticisms are far from being universally applicable—the stations are grouped in counties approximately in the order adopted in *British Rainfall*. All stations at which we believe that the thermometers are in a Stevenson screen have an S prefixed, and returns quoted from the publications of the Meteorological Office, have a † in addition.

Records of a Temperature (in shade) below 10° *between Jan.* 5*th &* 8*th*, 1894.

County.		Station.	Min.	Date.
			°	
Surrey		Woodhatch, Reigate.....	8·0	... 5
,, ...	S	Upper Gatton, Merstham	8·1	... 5
,, ...	S	Asylum, Caterham	9·0	... 5
,, ...	S	Wallington	7·7	... 7

County.		Station.	Min. °	Date.
Kent		Cranbrook	6 0	... 5
,,		Dover	9 0	... 5
,,		Camden Park, Tunbridge Wells	9·0	... 5
,,		River Hill, Sevenoaks	8·0	... 5
,,		Foxwold, Brasted	4·0	... 5
,,	S	Keston	8·0	... 7
Sussex		Bramber	7·0	... 6
,,	S	Ditchling	9·0	... 7
,,		Hayward's Heath	8·0	... 7
Hants		Newport, I. of Wight	9·5	... 7
,,		Swanmore, Bishop's Waltham	8·0	... 6
Berks		Portland Place, Reading	9·5	... 6
,,		Welford Park, Newbury	9·0	... 6
Herts		Broxbourne (Stafford Ho.)	5·0	... 7
Oxon		Henley-on-Thames	5·0	... 5
,,		Bloxham, Banbury	9·0	... 6
Northampton	S	Sedgebrook	9·0	... 6
Essex	S	Chelmsford	1·9	... 6
,,		Sheering, Harlow	8·0	... 6 & 8
,,		Old House, Dedham	−2·0	... 6
,,	S	Halstead	−1·5	. 6
Suffolk		Ipswich	6·0	... 6
,,		,, (Thornham Hall)	3·0	... 6
,,		Rendlesham Hall	9·0	... 8
,,	S	Great Thurlow, Haverhill	−0·5	... 6
,,		Framlingham	8·0	... 5
,,	S	Somerleyton, Lowestoft	9·1	... 8
Norfolk		Scole	−1·5	... —
,,		Diss	1·0	... 5 & 6
,,	S†	Geldeston [Beccles]	9·0	... —
Wilts		Devizes	9·0	... 5
,,		Pickwick, Corsham	9·0	... 5
Dorset		Whatcombe	7·0	... 5
Devon	S	Buckfastleigh	8·0	... 7
,,	S	Cullompton	8·2	... 7
Gloucester		Highlands, Minchinhampton	8·0	... 5
,,	S†	Cirencester	9·0	... —
Hereford	S	Burghill, Hereford	9·8	... 6
Shropshire		Ludlow	5·0	... 6
,,		Woolstaston	8·0	... 6
,,		Clive Vicarage	5·0	... 5
Stafford	S	Wrottesley, Wolverhampton	8·3	... 6
,,		Weston Park [Shifnal]	6·0	... 7
,,		Hoar Cross, Burton	5·0	... 5
,,	S	The Heath House, Cheadle	9·9	... 6
Worcester	S	Diglis, Worcester	8·0	... 6
,,		Orleton, Tenbury	5·5	... 6
,,		Kings Norton [Birmingham]	0·0	... 6
Warwick	S	Kenilworth	8·2	... 6
,,		Chadwick Manor, Knowle	1·0	... 6
,,		Springfield, ,,	−4·0	... 6
,,	S	Olton, Solihull	−0·5	... 5
,,		Priory Row, Coventry	4·0	... 6
,,		Stoke, ,,	−3·0	... 6
,,		Wellington Rd., Birmingham	9·0	... 6
Leicester		Barkby	7·0	... 5
,,	S†	Loughborough	5·0	... 5
Rutland	S	Ketton Hall	6·0	... 6
Lincoln		*Branston Hall*	4·0	... 8

County.		Station.	Min.	Date.
			°	
Lincoln	S	The Close, Lincoln	9·8	6
,,		Hemingby	6·4	6
Nottingham	S	Hodsock Priory, Worksop	—4·4	6
,,		Hesley Hall [Tickhill]	—0·2	6
Derby	S	Buxton	9·2	8
,,		Norton Hall [Sheffield]	2·0	6
Cheshire		Kelsall, Chester	8·0	6
Lancashire		Esthwaite, Hawkshead	8·1	6
Yorkshire, W.R.		Parliament St., Sheffield	1·0	6
,, ,,		Weston Park ,,	8·0	7
,, ,,		Beckett Hospital, Barnsley	4·0	6
,, ,,		Wentworth Castle, ,,	4·0	6
,, ,,		St. George's Gardens, Barnsley	0·5	6
,, ,,	S	Harewood Lodge, Meltham	6·7	6
,, ,,		Huddersfield	7·0	6
,, ,,	S	Prison, Wakefield	1 0	6
,, ,,		Bermerside, Halifax	3·0	6
,, ,,		The Stray, Harrogate	1·8	6
,, ,,	S	Knaresboro'	5·0	6
,, ,,		Burton House, Masham	—5·0	6
,, E.R.	S	Driffield	—0·8	6
,, N.R.		E. Layton [Darlington]	4·0	6
Durham		Whorlton, Barnard Castle	5·0	6
,,	S†	Durham	6·0	7
,,	S	Ushaw	5·0	6
,,		Hermitage, Chester-le-Street	5·0	6
,,		Deanery Gardens, ,, ,,	3·0	6
,,		Houghton-le-Spring	5·0	6
,,		New Herrington, Houghton-le-Spring	4·5	6
,,		Mowbray Park, Sunderland	7·0	6
Northumberland.		Newcastle-on-Tyne	6·0	6
,,		Royal Nurseries, Hexham	—6 0	7
,,		South Park, ,,	—6·0	7
,,		Hackwood, ,,	—5·0	7
,,		Dilston, ,,	—1·0	7
,,		Unthank Hall, Haltwhistle	4·0	6
,,	S	Cragside, Rothbury	5·0	7
Westmoreland	S	Windermere	8·0	6
,,		Appleby	7·0	7
Monmouth		The Hendre	9·0	5
,,		Llanvihangel Court	8·0	6
Radnor		Downton	5·0	6
,,		Llandrindod	2·0	5
Montgomery		Pool Quay, Welshpool	8·0	6
Kirkcudbright	S	Cargen [Dumfries]	6·8	6
Dumfries		Langholm	4·0	6
Roxburgh		Hawick	0·0	6
,,		Jedburgh	1·0	7
,,		Abbeygate, Melrose	—6·0	7
Selkirk		Galashiels	2·0	6
,,		Stow	—2·0	6
Peebles		N. Esk Reservoir	6·0	6
Berwick		Berwick	8·0	6
,,	S†	Marchmont	6·0	7
,,		Sisterpath, Greenlaw	—2·0	6
,,		Duns	0·0	6
,,		,, (Whitsomelaws)	—3·0	6
,,		,, (Langton)	—1·0	6
Edinburgh		Royal Botanic Gardens, Edinburgh	9·0	7

County.		Station.	Min.	Date
Stirling		Denny	2·0	7
,,		Bridge of Allan	—6·0	7
Fife		Markinch	1·0	7
,,		Ladybank	—8·0	7
Perth		Dunblane	0·0	7
,,		Muthill	—6·0	7
,,		,, (Pitkellony)	—3·0	7
,,		Bridge of Earn	—8·0	7
,,		Seggiedan, Kinfauns	—3·0	7
,,	S	Stronvar	—1·0	7
,,	S†	Ochtertyre	2·0	6
,,		Dunkeld	—8·0	7
,,		Aberfeldy	—5·0	7
,,		Alyth	9·0	7
,,		,, (Drumnacree)	—5·0	7
,,		Ballinluig	—2·5	7
,,		Pitlochry	—3·0	7
Forfar		E. Necropolis, Dundee	6·2	7
,,		Invergowrie, ,,	8·0	6
,,		Broughty Ferry	0·0	6
,,		Asylum, Dundee	3·0	7
,,	S	Cupar Angus	—11 0	6
Aberdeen	S	Braemar	— 4·0	6
,,		Cranford, Aberdeen	6·0	6
Elgin		Mossbrae, Elgin	8·0	7
Sutherland	S†	Lairg	8·0	—
Cork	S	Douglas, Cork	8·0	7
,,		Crawford Observatory, Cork	9·4	7
Waterford		Brook Lodge	2·0	7
Kilkenny	S†	Kilkenny	7·0	-
King's County	S†	Parsonstown	6·0	6
Longford	S†	Edgeworthstown	5·0	—
Armagh		Observatory, Armagh	6·3	6
Down		Seaforde	7·0	5
,,		Waringstown	0·0	5
Tyrone		Edenfel, Omagh	8·0	6

On plotting the above entries on a map, their general agreement is very striking. In South Wales, Devon, Cornwall, Somerset, and all along the coast from the Isle of Wight, round to the Land's End, and thence to Carlisle, there is but one record of a minimum of 10°, although few other portions of England and Wales are without considerably lower values; and there are five widely separated localities at which there can be little doubt that the shade minimum fell below zero. It has been stated that zero was reached at Tunbridge Wells and at Dover, but we can see no reason for believing, it any more than the fiction of 10° below zero at Fowey in Cornwall.* We have heard that zero and below it, were recorded in parts of Essex; and looking at the —1°·5 at Scole and —2°·0 at Old House, Dedham, it seems probable. The next area with very low temperatures, was the high land in Warwickshire, where there are several records below zero, one being in a Stevenson screen. N.E. of this area, we find North Nottinghamshire with the best obtainable instruments in a proper screen, giving an air minimum of —4°·4 at Hodsock Priory, backed by a record of —0°·2

*Really 10° below freezing—i.e. 22°.

at the nearest station, Hesley Hall. Finally—as regards England—we have a group of very low readings in the South of Northumberland. We have no information respecting these thermometers or their mounting, but the records agree so well that it seems hypercritical to assume that all are wrong.

In Scotland the South Eastern district around Melrose was as usual very cold, there being five reports of below zero; but this was surpassed in Perthshire and the west of Forfarsire, where the majority of the returns were below zero, eight of them were 5° or more below zero, and one, Cupar Angus, was —11°·0.

Probably the Irish returns, though not nearly so cold, were more remarkable. We do not think that any precedent can be found for nine records spread from Cork to Tyrone all below 10°.

The following notes may be of interest and help to complete the account :—

London.—The shade temperature did not fall below 13°·1, whereas 6°·7 was touched on Dec. 25th, 1860, and on January 4th, 1867, but the max. was almost unprecedently low.

Devon & Cornwall.—The cold of the past few days has been very severe in N. Cornwall and N. Devon. A correspondent from Stratton writes that a day or two ago he went to Newland, Bradworthy—between eight and nine miles. He says:—"When we reached the farmstead we found icicles, each three to four inches long, hanging from the horse's nostrils, whilst the outside parts of the bit were encased with ice from the breathing of the animal. My pipe was encircled with ice as thick as a penny just beyond where the lips came, and a drop of water falling on a gun barrel was converted into ice before one could stoop to brush it away. On the return journey, in the absence of a muffler, a handkerchief was used as a respirator, and then my breathing caused my coat collar on one side to be covered with ice.—*Western Morning News, Jan. 9th.*

Mowbray Park, Sunderland.—Min. on 6th 7°·0, the lowest for at least 20 years; the nearest was 9° on Dec. 4th, 1879.

THE RECENT COLD IN GUERNSEY.

To the Editor of the Times.

SIR,—Systematical meteorological observations have been taken in Guernsey during the last 50 years with standard certified instruments, and last Friday's readings broke the record for low temperatures. The mean temperature of that day was 21°·9, which is (excepting Thursday's, the 4th, mean) 5°·9 lower than the lowest daily mean previously recorded.

The air temperature at 8 a.m. on Friday, January 5th last, was 18°·1, the *maximum* for the day 26°·5, the 9 p.m. reading 24°·8, and the *minimum* for the day 16°·2. The mean, as above stated, was 21°·9—that is, no less than 20° too cold for that day of the year. The coldest day on record previous to this cold snap occurred on February 11th, 1870, the *minimum* for that day being 26° and the daily mean 27°·8.

These local observations were commenced 51 years ago by the late Dr. Hoskins, F.R.S., and are now carried on by Mr. A. Collenette, F.R.Met.Soc.

The still lower air reading of 16°·2 was taken by myself, with a certified instrument in a Stevenson screen at 8 a.m. on the 5th inst., while the *minimum* air

reading recorded during that night in the same screen was 15°·5. This reading is therefore 0°·7 lower than Mr. Collenette's observation. My station, however, is somewhat more exposed than Mr. Collenette's, and some 100 feet higher above the sea.

These unprecedented low temperatures, in an island with a climate generally so mild, are, I think, worthy of record in your columns.

Your obedient servant,

BASIL T. ROWSWELL.

St. Martin's, Guernsey, Jan. 9th.

Bridge of Earn, Perth.—Min. 8°·0; hen's eggs in the nest were split by the cold.

Finally, to sum up the whole matter, we have prepared the following table of the relative intensity of the frosts of December, 1879, January, 1881, and January, 1894, the facts as to the first two being taken from two excellent papers by Mr. Marriott in the *Quar. Jour. Roy. Met. Soc.* :—

Year.	Shoering, *Essex.*	Somerleyton, *Suffolk.*	Geldeston, *Suffolk.*	Cirencester, *Gloucester.*	Heath House, *Stafford.*	Coventry, *Warwick.*	Loughborough, *Leicester.*	Hodsock, *Notts.*	Buxton, *Derby.*	Wakefield, *Yorks.*	Durham, *Durham.*	Braemar, *Aberdeen.*	Parsonstown, *King's Co.*	Armagh, *Armagh.*	Waringstown, *Down.*	Mean
1879	**1°·0**	10°·0	11°·0	14°·0	17°·6	5°·0	**1°·5**	−5°·8	−3°·8	**0°·0**	4°·4	−0°·8	9°·8	17°·6	12°·0	6°·2
1881	9·0	**4·9**	**3·5**	**−0·3**	**9·9**	**3·0**	1·9	1·6	1·2	12·1	**0·2**	**−4·0**	**6·0**	9·8	**−1·0**	3·9
1894	8·0	9·1	9·0	9·0	**9·9**	4·0	5·0	−4·4	9·2	1·0	5·0	**−4·0**	**6·0**	**6·3**	0·0	4·7
Mean	6·0	8·0	7·8	7·6	12·5	4·0	2·8	−2·9	2·2	4·3	3·2	−2·9	7·3	11·2	3·7	5·0

The lowest temperature at each station is in heavy type, and this shows at once that the cold of 1881 was much more remarkable than that of 1894 or of 1879. The means for the three periods are interesting. Heath House, Cheadle, *looks* too high, but the explanation is that it is 650 feet above sea level, and the cold air can flow away from it. Hodsock Priory comes out lowest, and about equally so with Braemar, the reason probably being its low altitude (56 feet) and its rather central position, but it is not easy to see why it should be so much colder than Loughborough.

THE METEORIC PHENOMENA OF JANUARY 25TH.

I was induced by notices which appeared in the *Times* of January 29th, of a brilliant meteor observed on the above date, to ask for further information to be sent me on the subject. I have been favoured by a large number of reports, some sent direct, others collected by Mr. Symons, and others forwarded by Mr. H. C. Moore, the Secretary of the Woolhope Field Club.

The result of a comparison of these reports, is to shew that instead of one meteor on the night in question, there were several, while the attendant phenomena were remarkably similar.

I proceed to state, as briefly as the case will admit, the facts as reported in chronological order :—

6.45 *p.m.*—At *Whitecliff, near Seaton, Dorset*, a meteor brighter than Jupiter passed from E. to W. ; light of trail lasted 3 to 4 seconds. Two other meteors crossed S. to N. later in the evening ; time not stated.

8.10 *p.m.*, "*about.*"—The Vicar of *Pool Quay, near Welshpool*, saw a meteor pass from N.W. to S.E, from 45° down to 25° above horizon, giving sufficient light to cause the observer to turn round to see it. It shone through a haze.

I am inclined to think that this is the same as the one next to be noticed.

8.30 *p.m.*—At *Wallasey Hill, near Liverpool*, observer looking S.E. by S., saw a very large meteor fall in a nearly vertical line (slightly inclining W.) right ahead of him ; no explosion occurred ; sky covered with fleecy clouds ; heavy bank on southern horizon, into which meteor passed from sight.

Time not named.—Possibly the same as the last two. From near *Flint* a meteor was seen passing from Zenith to S.E., between two dense black clouds, and disappearing into another bank. Quivering light as of aurora visible from 10 to 11 seconds after disappearance.

9.30 *p.m.*—At *Llanthomas, near Hay*, a working man walking along the road, was "startled by the sudden appearance of a very brilliant light in the dark sky ; it seemed to be right overhead, and, as he looked up the sky seemed to open, and the light spread out gradually so bright, that you might pick up a pin in the road. The whole lasted quite a minute, and was accompanied by a rumbling sound towards the mountain E.S.E."

At the same place a woman described the light as coming through the window blind and lighting up the whole room for quite a minute if not more, and followed by a "rumbling, bumping noise."

Both these persons are positive that the time was 9.30 and not 10 p.m.

From the same place my correspondent reports that it was noticed to be remarkably warm just before the concussion occurred, and that several flashes of lightning were seen during the night.

At *Clifford* (2 miles from *Hay*) a low rumbling noise was heard, *followed by a slight* shake of the earth at 9.30 p.m. "About the

same time a comet [!] was seen flying in a southerly direction." —*Hereford Times*, Feb. 3rd.

10 *p.m.*—At this hour occurred the most remarkable event of the series. The observers agree very well as to the time. Some say the clocks were striking; most put it at 10.1 and only one as late as 10.4. It will be best to take the places in order from N. to S.

Chester.—Meteor emerged from behind a dense mass of black cloud in N.N.W., 40° above horizon; passed slowly across sky until hidden by another bank of cloud in S.S.E., about 30° above horizon. Sky between covered with filmy clouds. Visible for barely a minute; bluish green hue; brilliancy of a half-moon.

Stokesay Vicarage, Shropshire.—Sky covered with dense clouds; no meteor seen; but suddenly the whole landscape illuminated with a light so bright that objects were nearly as visible as in ordinary daylight. This lasted certainly more than half a minute. The light flickered and died out rapidly, not suddenly.

Bodenham, near Leominster. –Brilliant reflection, but meteor itself not seen. Explosion as of a cannon firing, apparently in the neighbouring valley. Further east, noise as of tiles falling. Concussion felt in houses.

Worcester.—Light as of an extremely vivid flash of lightning. The meteor appeared to burst to the southward, and after an interval, variously estimated at from 30 seconds (the most approximate) to 2 minutes, this was followed by a rushing, hissing sound, ending in an explosion like a tremendous peal of thunder.

Another correspondent from the same place, states that a ball of fire with a long tail was seen; doors and windows rattled and china was overturned.

Hereford.—Mr. H. C. Moore did not see the meteor or light, but heard a "report as of a well charged fowling piece in an enclosed space." There was no rumbling echo or vibration.

King's Pyon, near Hereford.—The Rev. H. A. Barker writes:—"Very overcast and dark; meteor resembling an incandescent lamp, having that peculiar luminosity which recalls the electric light, apparently half the size of the moon, rushing from N.E. to S. or S.W., followed by train of wavy bluish light; seemed to have a zigzag irregular motion; lasted 5 or 6 seconds; from 3 to 5 minutes afterwards loud report as of cannon."

Ross.—At the Graig (2 miles N.W.) a light was seen as "an appearance as of fireworks through the clouds," and an explosion was heard, accompanied by a distinct tremor with a wavy motion. At *Parkfields* (3 miles S.E.), two explosions were heard, with a rumbling between, which lasted until the second explosion occurred. Two shocks felt in upper floors of the house with undulating motion.

At midnight a violent squall of wind and rain burst half a mile west of *Ross*, felling a large tree and partially unroofing a gentleman's house.

Ashchurch, Tewkesbury.—I have no reports from the place, but

Mr. W. F. Denning, F.R.A.S., in *The Times* of January 31st, locates the meteor's disappearance at a point four miles north of this village. I do not venture to criticize his letter, as I do not know on what observations his conclusion is based, but I find it difficult to make it fit in with some of the reports noted in this paper.

But all the reports tend to show that the explosion (whatever that term in fact represents) did occur somewhere in the neighbourhood of *Ashchurch*.

Cheltenham.—Mr. Walker (*Times* of January 29th) saw the meteor pass over the town, travelling from N. to S., and exploding with a sound like distant thunder.

Brimscombe Vic., Stroud.—Mr. Lloyd looking N., saw a ball of fire passing from N. to S. Its sudden disappearance was followed in 1 or 1½ minutes by a series of explosions apparently from N.E., "like a number of field pieces fired in rapid succession, followed by a volley of musketry." There had been heavy rain and the meteor, which gave from 4 to 6 times the light of Venus, shone through clouds.

Sarsden, near *Chipping Norton*.—A lady writes that she and four others were walking at 10 p.m. and were "surprised to find that very gradually from having been very dark, we seemed to be in daylight for a space of what I should judge to be about two whole minutes. We looked to see whether there was any change in the sky to warrant it, but it seemed to be still quite dark up there."

Brixworth, Northampton.—"The firmament blazed out in all directions, N., S., E. and W. This lasted 7 or 8 seconds." No explosion reported.

Correspondents also mention brilliant meteors seen from *Streatham* and *Merstham* at 6.20 p.m. on January 26th, and from *Southwold* at 8.15 p.m. on January 28th, and from *Bodenham* on February 8th, at 0.31 p.m., in bright sunshine.

I certainly do not intend to theorize upon the foregoing facts, but there are some points to which it is well to direct attention.

The evening and night appear to have been generally stormy and electrical, ending with the violent squall at *Ross*. The light is described in many places, and as to more than one of the meteors, as coming on gradually, dying out gradually and flickering. One observer noticed a zig zag motion, while almost all agree that there was not a single sound but a continued series of sounds, which most compared to thunder.

These points suggest for consideration whether in this class of meteor we are dealing with aerolites at all, and not rather with electrical phenomena arising within the limits of our own atmosphere.

In this connection I may relate that in August, 1890, I was at *Tunbridge Wells*, and about 8 p.m. from *Mount Ephraim*, saw a "meteor" very brilliant in the early twilight, shoot right across the sky from N. to S., and disappear low down in the horizon over *Hastings*. Two hours later, at that spot in the horizon, sheet lightning

was visible. By the next morning the storm had crossed the Channel from France, and by the succeeding evening had burst on *Tunbridge Wells*, thus directly following up the path of the meteor in the reverse direction.

At the same time (for I do not suggest that "November meteors" are other than aerolites) I must add that my observance of the coincidence of meteors and electrical phenomena, dates from the November meteor shower of 1866, which I observed from Cambridge with an aurora lighting up the northern sky, and sheet lightning lighting up the southern.

I have enquired of Mr. W. H. Preece, F.R.S. whether any electrical disturbances of the telegraph and telephones in Worcester and adjoining counties were reported on the night of January 25th. He has been good enough to inform me that he has made inquiries and finds there are no records of such disturbances on that night, but all the telegraph offices in those counties would, with one or two exceptions, be closed at the hour I named (10 p.m.), and so if any disturbance actually occurred there would be no record.

JAMES G. WOOD.

A WET TIME IN THE WEST OF SCOTLAND.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall at this station between October 1st, 1893, and January 31st, 1894, is perhaps worthy of a special record. I append a summary of it:—

		Rainfall. in.
1893.	October	10·63
,,	November	13·25
,,	December	7·65
1894.	January	11·38
	Total in four months ...	42·91
	Average monthly fall	10·73

Yours truly,

W. D. ANDERSON.

Ardsheal, Ballachulish, Argyleshire, Feb. 1st, 1894.

EXCEPTIONAL FROST FORMATION.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent, Mr. White Wallis, will find in *Nature*, vol. xxxi. (Nov. 1884 to April 1885) pp. 5, 81, 193, 264, 480, letters referring to the ice formation which he describes. The last letter gives reference to other letters in preceding volumes. See also vol. xxxiii., p. 461.

Yours faithfully,

B. WOODD-SMITH.

Branch Hill Lodge, Hampstead Heath, N. W., Feb. 6th, 1894.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1893.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	93·6	18	44·8	29	77·1	56·4	53·5	66	131·9	39·0	1·61	11	5·0
Malta	95·1	2	66·2	11	86·9	70·1	67·5	71	148·8	60·8	·03	1	1·4
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	74·7	4	57·4	16	73·3	62·8	58·4	74	126·8	48·2	2·06	26	6·0
Calcutta	91·6	14	76·4	9	87·7	78·7	78·8	87	154·8	75·1	8·37	18	8·1
Bombay	86·2	1	74·8	16	84·2	76·8	75·1	84	140·5	72·3	13·55	28	8·8
Ceylon, Colombo	86·2	30	73·1	5	84·7	76·9	70·6	75	150·5	70·0	1·01	13	4·4
Melbourne	65·5	12	33·5	1	58·8	43·9	44·4	77	121·2	27·9	1·71	16	6·3
Adelaide	72·4	28	36·6	20	61·8	46·0	45·2	72	128·6	27·7	2·74	14	5·4
Sydney	72·4	15	42·8	4	61·9	48·5	43·0	82	120·9	29·1	2·08	14	3·7
Wellington	62·3	14	35·0	12	58·0	46·5	44·4	75	119·0	24·0	8·23	15	4·7
Auckland	64·0	24*a*	38·5	12	60·4	50·0	48·5	79	132·0	34·0	5·04	21	5·8
Jamaica, Kingston	91·5	25	68·2	28	89·1	73·7	72·3	80	...	...	2·21	9	6·1
Trinidad	93·0	29	68·0	21*b*	88·4	69·8	75·8	87	...	...	16·32	21	...
Toronto	88·8	11	48·7	14	76·7	56·6	57·3	74	...	44·0	5·76	12	3·7
New Brunswick, Fredericton	94·7	11	47·1	31	76·8	55·4	57·1	71	...	...	6·70	13	5·3
Manitoba, Winnipeg	89·8	7	35·0	28	75·7	50·1	...	...	...	...	1·52	12	4·5
British Columbia, Esquimalt	75·7	1	42·2	31	68·4	49·4	52·3	83	...	...	·06	3	2·5

a And 27. *b* And 22, 24, 30.

REMARKS.

MALTA.—Mean temp. 77°·7; mean hourly velocity of wind 6·0 miles. Lightning on 6th. J. SCOLES.

Mauritius.—Mean temp. of air 1°·2 below, of dew point 0°·7 below, and rainfall 0·10 in. below, their respective averages. Mean hourly velocity of wind 12·0 miles, or 0·2 mile below average; extremes, 32·1 on 29th, and 0·0 on 18th; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Dense fog on the 11th; frost on 6 days; hail, thunder and lightning on the 24th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·3 below the average of 36 years. Rainfall 0·40 in. above the average. A splendid season, fine winter rains being general over the pastoral and agricultural districts. C. TODD, F.R.S.

Sydney.—Temperature 0°·2 above, humidity 8°·7 above, and rainfall ·89 in. below, the average of 35 years. H. C. RUSSELL, F.R.S.

Wellington.—Heavy showers up to the 7th, 1·26 in. being recorded on 3rd, and 1·65 in. on 5th; showery on 10th and 11th, then fine weather for the remainder of the month, with showers at intervals. Prevailing winds N.W., frequently strong; snow on the hills on the 11th; hail on 11th; fog on 3rd and 4th; earthquakes on 4th and on 23rd; lunar rainbow on 25th. Mean temp. 4°·2, and rainfall 3·03 in., above the average. R. B. GORE.

Auckland.—From the 1st to the 19th wet, stormy and disagreeable; from thence to the end of the month much finer, excepting a heavy fall of rain on the 26th. Total rainfall much in excess of the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Fair, with afternoon showers and thunder; Rainfall half the average. Globular lightning seen near Kingston on 26th, and a shock of earthquake felt on 22nd. Mean hourly velocity of wind 3·7 miles. The first half of the month was free of depressions, but in the latter half three cyclones occurred within barometric range, but far to the N.E. and N. ROBT. JOHNSTONE.

TRINIDAD.—Rainfall 6·00 in. above the 30 years' average, and only exceeded by the fall for 1880, which was 17·39 in. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	4·26	XI.	Rhayader, Nantgwillt..	7·77
,,	Birchington, Thor	1·96	,,	Lake Vyrnwy	8·36
,,	Hailsham	4·07	,,	Corwen, Rhug	3·70
,,	Ryde, Thornbrough	4·82	,,	Carnarvon, Cocksidia ...	4·69
,,	Emsworth, Redlands ...	5·25	,,	I. of Man, Douglas	4·11
,,	Alton, Ashdell.....	4·31	XII.	Stoneykirk, Ardwell Ho.	5·06
III.	Oxford, Magdalen Col...	1·64	,,	New Galloway, Glenlee	8·23
,,	Banbury, Bloxham	1·64	,,	Melrose, Abbey Gate...	3·44
,,	Northampton, Sedgebrook	1·16	XIII.	N. Esk Res. [Penicuick]	5·35
,,	Alconbury	1·53	,,	Edinburgh, Blacket Pl..	2·47
,,	Wisbech, Bank House..	1·88	XIV.	Glasgow, Queen's Park.	4·87
IV.	Southend	1·93	,,	Inverary, Newtown	12·07
,,	Harlow, Sheering	2·19	XV.	Islay, Gruinart School..	3·28
,,	Colchester, Lexden.....	1·80	XVI.	Dollar.....	4·49
,.	Rendlesham Hall	2·01	,,	Balquhidder, Stronvar..	14·92
,,	Diss	2·33	,,	Dunkeld, Inver Braan..	...
,,	Swaffham	1·82	,,	Dalnaspidal H.R.S. ...	11·92
V.	Salisbury, Alderbury...	2·81	XVII.	Keith H.R.S.	1·71
,,	Bishop's Cannings	2·25	,,	Forres H.R.S.	1·61
,,	Blandford, Whatcombe.	4·47	XVIII.	Fearn, Lower Pitkerrie.	1·22
,,	Ashburton, Holne Vic....	7·22	,,	Loch Shiel, Glenaladale	15·91
,,	Okehampton, Oaklands.	5·40	,,	N. Uist. Loch Maddy ...	7·49
,,	Hartland Abbey	4·03	,,	Invergarry	9·69
,,	Lynmouth, Glenthorne.	4·91	,,	Aviemore H.R.S.	4·49
,,	Probus, Lamellyn	4·99	,,	Loch Ness, Drumnadrochit	3·75
,,	Wellington, Sunnyside..	3·28	XIX.	Invershin	2·88
,,	Wincanton, Stowell Rec.	3·01	,,	Scourie	4·47
VI.	Clifton, Pembroke Road	3·17	,,	Watten H.R.S.	2·12
,,	Ross, The Graig	2·73	XX.	Dunmanway, Coolkelure	9·52
,,	Wem, Clive Vicarage ...	2·30	,,	Fermoy, Gas Works ...	5·95
,,	Cheadle, The Heath Ho.	2·45	,,	Killarney, Woodlawn ...	9·34
,,	Worcester, Diglis Lock	1·92	,.	Tipperary, Henry Street	5·39
,,	Coventry, Coundon	1·61	,,	Limerick, Kilcornan ...	4·03
VII.	Ketton Hall [Stamford]	1·61	,,	Ennis	4·72
,,	Grantham, Stainby	1·66	,,	Miltown Malbay.....	4·73
,,	Horncastle, Bucknall ...	1·94	XXI.	Gorey, Courtown House	3·94
,,	Worksop, Hodsck Priory	1·37	,,	Athlone, Twyford	3·96
VIII.	Neston, Hinderton	1·38	,,	Mullingar, Belvedere ...	4·50
,,	Lancaster, Rose Bank...	3·56	,,	Longford, Currygrane...	4·03
,,	Broughton-in-Furness..	6·33	XXII.	Galway, Queen's Coll...	4·90
,,	Ripon, Mickley	4·32	,,	Crossmolina, Enniscoe..	8·94
IX.	Scarborough, South Cliff	...	,,	Collooney, Markree Obs.	5·92
,,	East Layton [Darlington]	1·79	,,	Ballinamore, Lawderdale	5·15
,,	Middleton, Mickleton..	3·72	XXIII.	Lough Sheelin, Arley ..	4·43
,,	Haltwhistle, Unthank..	3·16	,,	Warrenpoint	3·50
X.	Bamburgh.....	1·33	,,	Seaforde	4·56
,,	Newton Reigny	...	,,	Belfast, Springfield	4·81
XI.	Llanfrechfa Grange	4·05	,,	Bushmills, Dundarave...	4·57
,,	Llandovery	5·87	,,	Stewartstown	4·51
,,	Castle Malgwyn	6·75	,,	Buncrana	5·46
,,	Builth, *Abergwessin Vic.*	...	,,	Lough Swilly, Carrablagh	5·57

JANUARY, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. Nights below 32° In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·87	+ 1·25	·34	22	25	52·0	11*c*	13·1	5	14	18
II.		Maidstone (Hunton Court)...	2·16	+ ·61	·53	25	18	...	...	...	...	...	...
„		Strathfield Turgiss	3·13	+ 1·32	·28	21	26	51·2	11	12·8	5	13	24
III.		Hitchin	1·69	+ ·15	·28	14	22	52·0	12	10·0	5	13	..
„		Winslow (Addington)	1·88	+ ·07	·35	22	19	54·0	11	11·0	6	12	18
IV.		Bury St. Edmunds (Westley)	1·83	+ ·36	·41	14	22	52·0	17	...	...	...	...
„		Norwich (Brundall)	1·72	...	·36	27	22	53·4	16	11·5	8	12	21
V.		Weymouth(LangtonHerring)	3·37	+ 1·03	·57	8	26	50·0	17*c*	14·0	5	10	..
„		Torquay (Cary Green)	4·49	...	·51	8	26	53·1	11	19·4	6,7	9	11
„		Polapit Tamar [Launceston]..	4·19	+ 1·17	·60	10	22	56·5	11	16·0	7	4	13
VI.		Stroud (Upfield)	2·55	+ ·35	·29	9, 19	25	52·0	17	15·0	5	11	..
„		ChurchStretton(Woolstaston)	3·02	+ ·86	·43	8	26	49·5	11*a*	8·0	6	13	18
„		Tenbury (Orleton)	2·86	+ ·72	·35	4	18	55 0	11	5·5	6	11	16
VII.		Leicester (Barkby)	1·32	— ·44	·15	30	23	53·0	11	7·0	5	14	22
„		Boston	1·66	+ ·27	·25	14	20	50·0	12*e*	12·0	6	...	..
„		Hesley Hall [Tickhill].....	1·41	— ·36	·27	17	20	53·0	26	—0·2	6	13	..
VIII.		Manchester(PlymouthGrove)	2·51	+ ·05	·26	28	23	54·0	11	13·0	5	12	17
IX.		Wetherby (Ribston Hall) ..	2·31	+ ·42	·33	10*a*	15	...	...	...	...	...	...
„		Skipton (Arncliffe)	9·70	+ 4·06	·83	15	28	...	...	...	...	...	...
„		Hull (PearsonPark)	1·45	— ·32	·21	17	19	52·0	27	10·0	6,7	17	1
X.		Newcastle (Town Moor)	1·47	— ·34	·18	1	20	...	...	...	...	...	..
„		Borrowdale (Seathwaite).....	21·46	+ 9·28	4·36	26	25	...	...	...	...	...	..
XI.	WALES.	Cardiff (Ely).....	3·45	+ ·16	·46	15	23	...	...	...	...	...	..
„		Haverfordwest	6·48	+ 2·06	·70	12	25	51·9	11	15·0	7	11	1
„		Aberystwith, Gogerddan.....	3·43	— ·10	·65	21	19	52·0	10	14·0	5	12	..
„		Llandudno.....	3·02	+ ·74	·48	10*b*	23	57·4	16	15·0	6	8	..
XII.	SCOTLAND.	Cargen [Dumfries]	6·00	+ 2·23	·84	29	22	51·2	11	6·8	6	14	..
„		Jedburgh (Sunnyside).....	2·53	+ ·81	·70	27	13	51·0	13	1·0	7	13	..
XIV.		Old Cumnock	4·62	+ ·63	·78	27	24	...	...	...	...	...	..
XV.		Lochgilphead (Kilmory).....	9·32	+ 3 18	·90	26	26	...	...	20·0	1, 6	16	..
„		Mull (Quinish).....	6·74	+ 1·07	1·06	15	24	...	...	...	...	...	..
„		Loch Leven Sluices	6·20	+ 3·30	1·00	22	16	...	...	...	...	...	..
XVI.		Dundee (Eastern Necropolis)	3·15	+ 1·18	·50	30	22	50·0	16	6·2	7	17	..
„		Braemar	6·37	+ 3·68	·99	29	24	46·3	11	—4·0	6	20	28
XVII.		Aberdeen (Cranford)	2·51	...	·42	29	23	48·0	16*f*	6·0	6	17	..
„		Strathconan [Beauly]	7·35	+ 2·47	1·32	27	13	...	...	...	...	...	..
XVIII		Glencarron Lodge.....	11·03	...	1·75	26	24	...	...	...	...	...	..
„		Cawdor [Nairn]	2·40	+ ·23	·36	25	22	...	...	...	...	...	..
XIX.		Dunrobin	2·98	+ ·52	·41	26	18	50·0	24	22·0	7	17	..
„		S. Ronaldsay (Roeberry).....	3·33	+ ·38	·26	22	28	48·0	13	26·0	5*g*	15	..
XX.	IRELAND.	Darrynane Abbey.....	6·02	...	·85	8	26	...	...	...	...	...	..
„		Waterford (Brook Lodge) ...	5·98	+ 2·42	1·30	10	24	51·5	10	2·0	7	14	..
„		O'Briensbridge (Ross)	4·32	...	·59	31	26	...	...	...	...	...	..
XXI.		Carlow (Browne's Hill)	3·70	+ ·80	·41	30	23	...	...	...	...	...	..
„		Dublin (FitzWilliam Square)	2·84	+ ·98	·33	12	23	54·7	11	18·6	7	7	17
XXII.		Ballinasloe	4·48	+ 1·40	·55	16	25	53·0	23	15·0	6, 7	15	..
„		Clifden (Kylemore)	9·89	...	1·12	15	24	...	...	...	...	...	..
XXIII		Waringstown	3·40	+ ·75	·34	27	23	54·0	10	0·0	5	20	28
„		*Londonderry (Creggan Res.).*	5·41	+ 1·99	·48	12	24	...	...	...	...	...	..
„		*Omagh (Edenfel)*	6·64	+ 3·62	·72	26	24	50·0	10	8·0	6	17	29

a And 18. *b* And 30. *c* And 27. *d* And 16. *e* And 17. *f* And 21, 24, 28. *g* And 6,

+Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—January was a wet month, with a very severe snap of cold in the early part, the thermometer indicating a lower temp. on the 5th and 6th than has been recorded at this station, with the exception of December 25th, 1860, and January 17th, 1881.

ADDINGTON.—Severe frost from 1st to 8th, but very little afterwards. The 4th was a bitterly cold day, with high wind and frost, and the 5th was remarkable for its very low max. (15°), the min. of the month (11°) really occurring on the evening of that day. S fell on the 4th and 5th, and on the evening of the 31st.

BURY ST. EDMUNDS.—R or S fell in small quantities on 22 days. A sharp spell of cold occurred from the 3rd to the 9th, the max. on the 5th being 18°, and the min. on 6th (exposed ther.) 3°. The rest of the month was comparatively mild. S daily from 2nd to 6th.

NORWICH, BRUNDALL.—January was remarkable for its extreme variations of temperature, the first week giving lower readings than are sometimes recorded in our most severe winters. On each of the four nights 5th to 8th inclusive the temp. fell below 20° in the screen. The remainder of the month was mild, and the weather of the cyclonic type, the result being that the mean temp. of the month (mean of max. and min.) was 37°·3, or in close agreement with the average. Snowdrops and winter aconites in full flower before the close of the month.

LANGTON HERRING.—A most unsettled month. The weather was very severe on the first nine days; for five days (3rd to 7th inclusive) it did not cease freezing, and the intense cold on the 5th was quite exceptional, the max. between sunrise and sunset being only 17°; the temp. fell to 16° at 4 p.m., rose to 20° by 9 p.m., and to 23° by 9 a.m. on the 6th; the 5th was the coldest day for 22 years. From the 10th to the 22nd it was mild and very damp. From the 23rd to the end of the month the temp. was very variable. The mean for the month at 9 a.m. (37°·9) is just 1° below the average of 23 years. Fogs on 4 days. L on the 30th.

TORQUAY, CARY GREEN.—S on the 4th, 5th, and 6th, about 12 inches deep.

POLAPIT TAMAR.—Very cold during the first eight days, the ther. on grass on the morning of the 7th reading 4°·5 above zero, the lowest observed here during the past eight-and-a-half years. Altogether unusually wet and stormy. T on 28th. H on 31st.

STROUD, UPFIELD.—A slight fall of S on the 2nd; on the 4th, bitter easterly gale with S at times, and S on the 5th and 6th; S.W. gales on 27th and 30th, and S. gale on 29th. The meteor of the 25th was seen by few in this neighbourhood.

WOOLSTASTON.—A rather wet month. S fell on 6 days. The first 9 days were bitterly cold, the 5th exceptionally so, the max. temp. being 18°·5; the coldest day remembered here. This was succeeded by some days of warm spring-like weather, but the latter part of the month was again cold. Mean temp. 36°·7. Violent H on the 29th.

LEICESTER, BARKBY.—A fine month on the whole; sharp frost in the first week. The R fell in small quantities, mostly at night, and more is needed. Very strong winds for many days. Mean temp. 36°·3.

MANCHESTER.—The first day was spring-like, then followed bitterly cold weather, with very low temp. on the 5th. Spring-like weather prevailed from 10th to 13th. Thick fog on the 23rd up to 10 or 11 a.m. From 24th to the end of the month very unsettled. Mean temp. 38°.

HULL, PEARSON PARK.—Sleet on 1st and 24th. Showers of H and S on 2nd, 3rd and 4th. S on 5th and 6th. Fogs on 7th, 8th and 31st. Stormy on 26th, 27th and 29th.

SEATHWAITE.—Falls of R exceeding an inch occurred on 8 days. S on 5th, 9th, and 28th *to 30th. H on the* 26th.

WALES.

HAVERFORDWEST.—The first eight days of the month were exceptionally severe, partly owing to the dryness of the air and the severity of the furious easterly gale, which blew with exceptional violence from the 4th to the 6th, the sky all the time covered with a black pall of cloud, notwithstanding which the mercury did not rise higher than 22° during the 5th; on the 6th, at 3 p.m., a regular blizzard occurred, 4 inches of S falling in an hour. The S in several places near the coast and to the south of the county varied from 5 to 8 inches in depth. The remainder of the month was continuously wet, stormy and mild, prevailing winds S., S.W. and W.

GOGERDDAN.—Very stormy and changeable throughout the month; very little sunshine.

SCOTLAND.

CARGEN.—A very unsettled, stormy month; very marked and extreme fluctuation of pressure. A remarkable lunar halo was observed on the 20th, two distinct rings with marked prismatic colours. S on 8th.

JEDBURGH.—In the early part of the month the weather was mild and occasionally agreeable; towards the close it was cold with storms of wind and R, and low temp. and pressure.

OLD CUMNOCK.—Stormy on 11th and 12th, S on 2nd, 3rd, 5th, 25th to 28th, and 31st.

MULL QUINISH.—A wild and stormy month with continual gales from all quarters, and much S and R.

BRAEMAR.—On 6th the temp. in shade fell to—4°·0, and on grass to—9°. The same temp. occurred on the same date in 1893.

ROEBERRY.—A very coarse unsettled month throughout; mean temp. 37°·7.

IRELAND.

DARRYNANE ABBEY.—Very hard frost from 4th to 7th. Aurora on 9th. The rest of the month very wild and changeable. Heavy H shower on 28th. S on 6th.

WATERFORD, BROOK LODGE.—A very wild, cold month. S on 5 days. H on 17th. Gale from S.W. on 11th, and from S. on 19th. Mean temp. 39°·8.

O'BRIENSBRIDGE, ROSS.—A decidedly wintry and unpleasant month; R every day after the first week, with gales of wind chiefly from S.E., at times violent. L on 28th and 29th. S, H, and sleet at the end of the month, with frost on the last three days.

DUBLIN.—The month opened with a spell of easterly winds and intensely cold weather, but ultimately proved wet, open, and stormy, with an almost uninterrupted prevalence of S.W. and W. winds. Mean temp. 41°·0, slightly below the average. Lunar coronæ were seen on the 16th and 17th. Foggy on three days. High winds on 21 days, reaching the force of a gale on 9 days. H fell on 7 days, and S or sleet on 7 days. Temp. exceeded 50° in the screen on 13 days, and fell below 32° on only 7 nights. L on the 7th.

WARINGSTOWN.—An intense frost was registered on the morning of the 6th; no sign of it on the previous night, which seemed to promise heavy S; the extreme cold lasted only a few hours in the early morning, but the effect on shrubs was most disastrous; herbaceous plants escaped, being covered with S. The lowest temp. previously registered were —1°·0 on January 21st, 1881; 6° on December 23rd, 1870; 2° on January 2nd, 1867; 7° on December 24th, 1860.

OMAGH, EDENFEL.—The month commenced in fine, dry, and frosty weather preparatory to the S which fell to an average depth of 6 inches on the 4th and 5th, accompanied and followed by temperatures falling as low as 8° at 10 a.m. on 6th (from 15° at 9 a.m. the same morning). On the 8th the frost and S disappeared in a mild spell and a rainfall that increased in persistence and amount to the end of the month, varied by sleet, S, H, and high winds and weather of extreme rawness and severity. The wettest January in 30 years except 1877.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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A WET FEBRUARY IN EDINBURGH.

WHEN the rainfall in any month is double the average due to that month, few persons can deny that it has been a wet one. When the fall is three times the average, the fact is so exceptional that it ought to be put on record. And there can be but few instances such as that we have to quote of more than 4½ times the average. In different parts of Edinburgh observations of rainfall have been made for 116 years, the wettest previous February was 1848 with 5·21 in.; in 1894 at Napier-road, it was 7·62 in., and in Charlotte-square, 6·38 in.

The following little table gives six stations at which the fall practically reached or exceeded three times the average:—

COUNTY.	STATION.	FEBRUARY. Average for 1880-89 in.	1894. in.	1894. per cent of average.
Edinburgh	Charlotte Square, Edinburgh ...	1·39	6·38	459
,, ...	Alnwick Hill, Libertou	2·07	7·60	368
Kinross	Loch Leven Sluice	2·75	9·20	335
Edinburgh	Glencorse, Pentland Hills	2·89	9·30	322
Renfrew	Queen's Park, Glasgow	2·95	8·96	305
Haddington ...	Smeaton, Prestonkirk	1·22	3·65	299

From the above district, with the vicinity of Edinburgh for a centre, the exceptional character of the fall gradually decreased, so that in the extreme W. and N. the fall was very slightly above the average.

The fall was excessive both actually and relatively, chiefly the latter, with which we have already dealt as far as the data yet received enabled us.

As regards the total fall we have received 21 Scotch records, each exceeding 11 inches, the highest being 32·30 in. on Ben Nevis, and 19·43 in. at Glen Quoich; although neither is unprecedented for one or more months in the year, we can find no instances of greater falls in February at those two stations.

We are indebted to Mr. Mossman for details respecting the excessive rainfall of February in Edinburgh, and for some extra returns.

MILD WINTER WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—I do not know whether it has ever been observed, that for a long time past (since the beginning of the century at least), we have had a conspicuously mild *first quarter* of the year (judging by mean temperature) every 12 or 13 years.

Noting that the average mean temperature for this quarter for 130 years (according to Buchan) is 39°·8, we have the following :—

	Mean Temp. 1st quarter.	Interval.
1809	42°·1	—
1822	43·1	13 years.
1834	43·7	12 ,,
1846	44·3	12 ,,
1859	43·8	13 ,,
1872	44·2	13 ,,
1884	43·6	12 ,,

There are no other values over 43°·0 since 1800.

According to this we might expect the first quarter of 1896 or 1897 to have a very high mean temperature.

Those mild first quarters seem to have been followed (with one exception, 1809, the lowest), by fine hot summers. I append a few notes about this from Baker's *Records of the Seasons*, &c. :—

1822.—"Hot summer." "No rain from May 2nd to July 5th." "Nine weeks of very hot days." "Full average produce. Quality universally good."

1834.—"Long drought." "A most productive harvest." "Extremely hot all the summer."

1846.—"This was a notably hot summer." "June, July, and August, 4°·2 above average temperature." "The hottest June on record."

1859.—"Good crops of hay and corn." "Early harvest." "An extremely hot summer." "The hottest July on record."

1872.—"In South of England, good crops and fine weather to secure them."

1884 (Mr. Glaisher.)—"The weather was very favourable for harvest work, and the grain crops were gathered in good condition."

I find in the *Met. Mag.* for June, 1870 (p. 80) Mr. Brumham offering proof that where January or February is dry and mild, the summer following is hotter than the average.—Yours faithfully,

A.B.M.

METEORS AND ELECTRICAL PHENOMENA.

To the Editor of the Meteorological Magazine.

SIR,—With reference to Mr. J. G. Wood's letter in your February number, descriptive of certain bright meteors seen on January 25th, 1894, I fancy that the question as to their coincidence with electrical phenomena is not a promising one for discussion. Though I have habitually observed meteors for some years, and taken care to note *other appearances*, such as auroræ, lightning, &c., when visible during

my watches, I could never trace evidence of association between them. Occasionally there have been coincidences of apparition, but these must have occurred in the ordinary course of nature, and cannot be supposed to have indicated mutual relation.

On August 9th, 1893, during the progress of the Perseid shower of meteors, lightning was surprisingly frequent and vivid the whole night long. Mr. E. J. Lowe, at Chepstow, estimated the number of flashes as 11,540! But no one supposes the two phenomena to have had any correlation. One was purely astronomical, having an extra-terrestrial origin and a general operation; the other was merely atmospheric and local in its action.

Your correspondent suggests that in the case of large meteors similar to that of January 25th last, "we may not be dealing with aerolites at all, but with electrical phenomena arising within our own atmosphere." I think such an idea has little to recommend it. It is going back to the untenable theories of our forefathers. Among other features, the visible aspect of the recent fireball afforded the clearest indication of its aerolitic character. Its appearance was that of a projectile in a state of incandescence rapidly undergoing violent disruption. Near the end of its flight it broke up into fragments, and finally scattered its material in a train of sparks, which disappeared immediately. Many persons must have been impressed with the correct idea that it was a body of solid matter being dissipated under the action of intense heat.

The real path of the fireball in our atmosphere, where it fell from a height of 89 to 16 miles, affords also very strong proof that it came from an exterior source.

The descent and destruction of a large aerolite comparatively near the earth's surface must cause a certain amount of disturbance in the atmosphere, and the shock may possibly be such as to induce a shower of rain. But the ordinary height of meteors is so far above that of rain-clouds that the latter are not likely to be much affected except in particular cases.

I have witnessed many fine showers of meteors without noticing any simultaneous evidences of electrical action of a visible nature. Large isolated meteors of very brilliant character have also been recorded without any accompanying phenomena.

It seems to me that the astronomical theory of meteors, in its general application, explains the observed features of these bodies so well that we have no need to go farther afield for another. There are, it is true, one or two details in the behaviour of meteoric radiant points which are perhaps not quite consistent with approved ideas; but this branch of astronomy is of modern date only, and further observation will doubtless clear away the trifling anomalies at present existing.

Mr. Wood, in referring to my computation of the real path of the fireball of January 25th, says he "finds it difficult to make it fit in with some of the reports" noted in his paper. Surely your

correspondent does not need the experience to see that it is an impossible feat to obtain a definite result that shall be accordant with the whole of such a miscellaneous collection of descriptions? Newspaper reports are notoriously erroneous, and it is rarely that inexperienced persons are accurate in their impressions of an event so sudden and startling as the outburst of a brilliant meteor. No deduction will satisfy the whole of the records, as they disagree amongst themselves. Fortunately, several reliable amateur astronomers observed the recent fireball, and I think I may consider my computation approximately correct. If it does not fit in with every account, there is really nothing surprising in the circumstance.

W. F. DENNING.

Bristol, February 23rd, 1894.

A NOONDAY METEOR.

To the Editor of the Meteorological Magazine.

SIR,—You may think it worth recording in your Magazine that a fine meteor was seen here by my brother on the 8th inst. at 0.35 p.m. travelling from West to East. The sun was shining at the time, but my brother had his back to the sun and the meteor was low down in the northern half of the sky. I observe by the newspapers that others saw it on that day, thereby confirming what I had almost doubted as an accurate observation, so bright was the day.

Yours faithfully,

M. LLEWELLYN EVANS.

2, *Naunton Park Villas, Cheltenham, Feb. 18th*, 1894.

[This meteor (an exceptionally fine one), was seen from Dublin by Dr. Rambaut, the Royal Astronomer of Ireland, who subsequently collected observations and published an account of it. It was seen from scores of places of which the limits seem to be W. Ballinasloe (Galway), E. Lynn (Norfolk), S. London, N. Glaslough (Monaghan), and Beverley (York.)

Dr. Rambaut found the positions to be—

APPEARANCE.		DISAPPEARANCE.	
Longitude 3°52′ W *Latitude* 53 36 N	or about 20 miles N. of Llandudno.	*Longitude* 1°36′ W *Latitude* 53 44 N	or in a triangle formed by Leeds, Halifax and Wakefield.
Altitude About 87 miles.		*Altitude* About 20 miles.	

On plotting the localities whence Dr. Rambaut received reports, we find that almost all are south of the path of the meteor, and very naturally so, because magnificent as it was, few persons would notice it while looking southwards, *i.e.*, *towards* the sun, which was shining brilliantly.

It must have been a very grand object to have been distinctly visible in broad sunshine from distances exceeding 200 miles.

Before concluding, we must point out that the time records are again bad. Dr. Rambaut gave 0 h. 28 m. Greenwich time, but Miss *Compton said* "at noon," the Rev. R. P. Dansey, of Stourbridge, *0 h. 30 m., and the* above letter gives 0 h. 35 m. p.m.—ED.]

THE AURORA OF FEBRUARY 28TH.

To the Editor of the Meteorological Magazine.

SIR,—The brilliant aurora of February 28th was observed here under conditions so favourable that I think it may be worth while to send you some notes of my observations, in the hope that from a comparison of these with similar observations made by others elsewhere, it may be possible to compute the position and altitude of the luminous arches which were so conspicuous a feature in the display.

The characteristic arc of yellowish light in the northern sky was first observed at 6.45 p.m., and was unusually bright, the southern edge cutting the horizon at points a few degrees N. of E. and S. of W., thus showing that the diameter of the arc was, as usual, in the line of the magnetic meridian. The centre of interest was, however, not here, but in the southern heavens, where from 7 to 8 p.m. there were visible two lines of luminous patches or streaks, forming broken arches, extending from the eastern to the western horizon.

In appearance these were not unlike the gauzy, filmy cloudlets which are sometimes seen early on a fine summer's day, when the morning mist is dispersing and breaking up. They varied greatly in brightness from time to time, sometimes glowing brilliantly and then fading, and at times they disappeared quite suddenly, and after a few moments re-appeared as suddenly, always maintaining their relative positions. Neither of the lines of luminosity formed a complete arch at any time; there were always distinct intervals between them; and the whole system (if I may so express myself) underwent a slow but distinct movement from N. to S. and from E. to W. The southward movement was estimated at 60° in 35 minutes; the westward movement at 10° in 20 minutes.

At 7.10 p.m a large luminous patch in the line of the upper arch was a little above Procyon, and a similar patch in the line of the lower arch was a little below that star.

At 7.25 p.m. the lower edge of the lower patch was just above Sirius.

At 7.34 p.m. the central portion of a luminous patch covered the belt of Orion.

About 7.45 p.m. both of the luminous arches began to fade, and by 8 p.m. had entirely disappeared, and, as far as my observations went, did not re appear. The luminous arc in the North, though gradually becoming fainter, was visible till a late hour, but, with the exception of one sudden outburst of red streamers at 9 p.m., which lasted only three or four minutes, did not emit any of the coruscations which are usually associated with bright displays of the aurora. Another peculiarity of this display was the absence of any flashing or undulatory movement in the detached luminous patches, the changes in brightness, though frequent, being gradual and steady, as in the case of a lamp when the wick is very gradually raised and lowered.

G. T. RYVES, F.R.Met.Soc.

Tean Vicarage, Stoke-on-Trent, March 7th, 1894.
Lat. 52° 57′ N. Long. 1° 59′ W.

SUN SPOTS AND AIR TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—In the number of your Magazine for September last there is a discussion by "A. B. M." of the relation between sun spots and air temperature, employing for the purpose the mean monthly temperatures for London, as given by Dr. Buchan in a paper on "The Temperature of London for 130 years, from 1763 to 1892," *Journal of the Scottish Meteorological Society*, vol. 9, p. 213. Combining all the years of sun spot minimum, he compared the resulting mean monthly temperature with the corresponding mean monthly temperature, obtained by combining all the years of sun spot maximum, confining the comparison, however, to the six months from April to September. He treated similarly the series of years preceding by one year the years of sun spot minimum and sun spot maximum, and also the series of years following by one year the same epochs. This gave 18 differences, the monthly means in the minimum years being greater than in maximum years in 14 cases, and smaller only in 4 cases, a considerable preponderance, which "A. B. M." thought to be "perhaps noteworthy."

A result of this kind cannot be accepted as in any way valid without some conclusive proof that it is really due to the assigned cause; for, it is to be remarked that the resulting differences are small as compared with the very large variations of temperature which examination of any considerable table of temperature reveals, and may be simply accidental errors arising from the combination of the temperatures of the particular years involved. If, however, the differences are real, a different combination of the data employed by "A. B. M." should bring out a corroborative result. In doing this I have extended the comparison to all months of the year, since there appears to be no reason for confining it to the summer months. Instead of combining *all* the years of sun spot minimum, I have divided the whole series into two groups, including in group No. 1 the first, third, fifth, &c., years of sun spot minimum, and in group No. 2 the second, fourth, sixth, &c., years, forming monthly mean temperatures for both groups, which two sets of concluded means should be alike representative of the whole period discussed. The years of sun spot maximum were similarly formed into two groups, which, as referring to sun spot maximum, should also be representative of the whole series. In each case the year immediately preceding and the year immediately following sun spot minimum or maximum is included, in order to render the results strictly comparative with those of "A. B. M."; the very same years are indeed employed, the only difference being that, to save space, the three years at each epoch are combined, instead of forming in each case three sets of numbers.

Comparing now the means of minimum group No. 1 with those of *maximum group No. 1*, and the means of minimum group No. 2

with those of maximum group No. 2, we have as follows:—

Month.	Sun Spot Groups No. 1. Min.	Max.	Excess of former.		Sun Spot Groups No. 2. Min.	Max.	Excess of former.
	°	°	°		°	°	°
January	37·61	37·74	−0·13	.....	37·34	36·86	+0·48
February	39·87	40·72	−0·85	.....	39·97	40·29	−0·32
March	41·76	41·93	−0·17	.....	42·38	43·30	−0·92
April	47·69	45·81	+1·88	.....	48·12	48·50	−0·38
May	55·06	54·02	+1·04	.....	54·98	55·49	−0·51
June	60·64	59·53	+1·11	.....	60·71	59·83	+0·88
July	63·64	62·69	+0·95	.....	62·88	64·33	−1·45
August	63·53	62·43	+1·10	.....	62·71	63·52	−0·81
September	59·44	57·29	+2·15	.....	58·75	58·40	+0·35
October	52·38	50·72	+1·66	.....	50·52	51·83	−1·31
November	44·38	42·20	+2·18	.....	44·08	43·95	+0·13
December	39·00	39·21	−0·21	.....	39·51	39·53	−0·02
The Year	50·41	49·53	+0·88	.....	50·16	50·48	−0·32

In regard to sun spot effect, the two sets of monthly differences are directly comparable, and should give a like indication. But in six of the months the signs are different; in three other months they are similar and both +, and in the three remaining months also similar, but both −. The result is in every way contradictory. Had minimum group No. 1 been compared with maximum group No. 2, and minimum group No. 2 with maximum group No. 1, a result no more harmonious would have been obtained.

It always seems well, when the suggestion of sun spot influence appears to be in some degree supported by figures, to probe the matter as completely as possible, in order to see whether they truly indicate any real effect.

W. E.

February 28th, 1894.

ROYAL METEOROLOGICAL SOCIETY.

The annual meeting of this Society, was held on Wednesday evening, January 17th, at the Institution of Civil Engineers, Westminster, Dr. C. Theodore Williams, President, in the chair.

The Council in their report, stated that the Society had made steady and uninterrupted progress during the year, there being an increase in the number of Fellows, and the balance of income over expenditure, being greater than in 1892. They also reported that Dr. C. Theodore Williams, previous to vacating the office of President, had expressed a desire for the formation of a fund for carrying out experiments and observations in Meteorology, and that he had generously presented to the Society the sum of £100, to form the nucleus of a Research Fund. The Society lost by death during 1893, nine Fellows and two honorary members.

The President, Dr. C. Theodore Williams in his valedictory address, gave an account of the climate of Southern California,

which he made most interesting by exhibiting a number of lantern photographs. In the autumn of 1892, Dr. Williams visited this favoured region, chiefly with a view of investigating its present and future resources and its suitability for invalids. After describing the entrance into California from Utah and Nevada, the general geological features, and physiography, he pointed out that the mountain shelter is tolerably complete, and that the protected area consists of (1) valleys, chiefly running into the coast range from the sea, and rising to various elevations, such as the fertile San Fernando and San Gabriel valleys; or else (2) more or less extensive plains, as those of Santa Aña and San Jacinto. Southern California is subdivided into two portions—eastern and western, by the Sierra Nevada and its spurs, the San Gabriel and San Bernadino mountains. The climate of the eastern portion, which is an arid region, is very dry, very hot in summer, and moderate in winter. The climate of the western portion has three important factors, viz.: (1) its southern latitude; (2) the influence of the Pacific Ocean, and especially of the Kuro Siwo current, which exercises a similar warming and equalizing influence on the Pacific coast of North America as the Gulf Stream does on the western coasts of the British Isles and Norway; and (3) the influence of mountain ranges; these affording protection from northerly and easterly blasts, and also condensing the moisture from the vapour-laden winds blowing from the Pacific. Dr. Williams then gave particulars as to the temperature and rainfall at Los Angeles, San Diego, Santa Barbara, and Riverside. From these it appears that the climate of Southern California is warm and temperate, and on the whole, equable, with more moisture than that of Colorado; and that it is a climate which would allow of much out-door life all the year round. The President next described the effect of the climate on vegetation, and showed what results had been obtained by irrigation and gardening in this beautiful region. Wine and brandy are made in South California, but oranges and lemons are the leading crops, varied with guavas, pineapples, dates, almonds, figs, olives, apricots and plums. On higher land, apples, pears and cherries bear well, and our English summer small fruit is also grown; while strawberries ripen all the year round, and are plentiful except in July and August. Dr. Williams concluded by saying that many an invalid has regained vigour and health, as well as secured a competence, in the sunny atmosphere of Southern California.

At the close of his address, Dr. Williams introduced to the meeting the newly-elected President, Mr. R. Inwards, F.R.A.S. Mr. Henry Perigal, F.R.A.S, was re-elected Treasurer, Mr. F. C. Bayard, L.L.M., and Mr. G. J. Symons, F.R.S., Secretaries, and Mr. R. H. Scott. F.R.S., Foreign Secretary.

THE monthly meeting of this Society was held on Wednesday evening, February 21st, at the Institution of Civil Engineers, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. M. Barrington, M.A., LL.B., Mr. C. G. L. Cator, and Mr. H. Owen were elected Fellows of the Society. The following papers were read :—

(1). "Temperature, Rainfall, and Sunshine at Las Palmas, Grand Canary," by Dr. J. Cleasby Taylor. The author gave the results of his observations during the five years 1889-93. The island of Grand Canary occupies a position midway between the African continent and the most western of the Canary group. The mountain peaks rise to a little over 6,000 ft., and are about 20 miles from the coast. The chief town and port of the island, Las Palmas, is consequently free from the influence of the mountains. The diurnal range of temperature fluctuates considerably with the variations in wind and sunshine. With a southerly wind (which usually dies down at sunset) the range is increased, but the greater part of the increase is due to a higher day temperature. With northerly winds persisting after sunset, the range may be very slight, particularly if the day has been cloudy. The sea temperature is dependent on causes outside the limits of the archipelago ; local presence or absence of sunshine does not cause any difference. A boisterous northerly wind, with a high sea, may cause the temperature to fall more quickly than usual, or, if the temperature is rising, may check the rise ; but any sudden variation is very rare. The rainfall is not great, though it is spread over a large number of days, the average yearly amount being 8·90 in. The greater part of the rain falls during October to January, while the period from June to September is practically rainless.

(2). "Report on the Phenological Observations for 1893," by Mr. E. Mawley, F.R.Met.Soc. This is a discussion of the observations made on the flowering of plants, appearance of insects, and the song and nesting of birds. The year 1893 was in complete contrast to its predecessor, being very forward throughout the United Kingdom. The February and March plants were later than usual in blossoming, especially in the colder parts of our islands, but after this the dates were everywhere in advance of the average, and during the height of the flowering season the departures from the mean were often considerable.

(3). "Comparative Observations with two Thermometer Screens at Ilfracombe," by Mr. W. Marriott, F.R.Met.Soc. Some exception having been taken to the thermometer screen which has been in use at Ilfracombe for a number of years past, a Stevenson screen was placed at a distance of 60 feet from the old screen in October, 1892, since which date simultaneous observations in the two screens have been made daily at 9 a.m. The results of this comparison show that the temperatures deduced from the two sets of observations agree very closely, the old screen giving a mean only 0°·3 higher than the Stevenson.

RAINFALL IN NATAL, AND THE SOUTHERN ICEBERGS.

Natal—or at any rate, part of the colony—was visited by exceptional rains in September, October and November, 1893.

The Rev. A. H. Stocker, who formerly kept the record of the fall of rain at Ovington, Hampshire, went to Ennersdale, Natal, early in 1893, writes, January 25th, 1894:—"The summer here—the wet season (October to February)—has been so far awfully wet:—

	in.	
September	5·66	(far above the average).
October	4·73	
November	12·05	(3 miles off it was over 16·00).
December	6·10	
January 1–25	8·71	

Total in less than 5 months, 37·25 in.

and February still to come, which generally has the highest average monthly rainfall."

To this we add the following table, which shows that in 1893 the monthly fall at the two stations was very differently:—

Rainfall at Mount Edgecombe from 1887 *to* 1893, *compiled by Mr. Marshall Campbell*:—

	1887.	1888.	1889.	1890.	1891.	1892.	1893.	MEAN.
	in.	in.	in.	in.	in.	in.	in.	in.
Jan.	3·17	4·38	9·06	1·86	4·15	2·03	6·76	4·49
Feb...	4·20	3·29	2·97	3·90	4·44	5·45	7·59	4·55
March.....	2·17	6·49	1·96	2·18	10·52	1·80	3·33	4·06
April	2·64	2·01	1·69	5·68	·60	·15	3·34	2·30
May	4·37	3·07	1·71	·73	2·74	2·79	3·89	2·76
June.	·34	·43	·20	·64	1·06	—	·12	·40
July.....	·49	1·37	·18	—	3·33	·18	·76	·90
August	1·94	1·10	1·32	·43	1·23	4·09	1·42	1·65
Sept.	1·00	4·20	1·00	·55	·79	4·45	11·87	3·41
Oct..	1·66	3·58	4·56	4·64	2·45	4·42	17·94	5·61
Nov.	1·93	1·58	1·98	3·99	4·11	5·38	7·00	3·71
Dec.	2·23	3·00	1·64	5·36	6·11	4·77	3·88	3·85
Total...	26·14	34·50	28·27	29·96	41·53	35·51	67·90	37·69

Natal Witness, January 12th, 1894.

The total for 1892 is printed as 35·31.—ED. M.M.

Finally we give Mr. Nevill's opinion upon the subject:—

"The Natal Government Astronomer, Mr. E. Nevill, gives it as his opinion that there is no just reason for ascribing wet seasons or droughts to the effect of spots in the sun, or other temporary disturbances in the normal equilibrium of that body. Attempts have been made by certain meteorologists to connect terrestrial weather disturbances with certain solar phenomena, but only with indifferent success. It is easy to find such coincidences between the times or periods of different classes of phenomena, but mere coincidences of this kind do not justify their being classed as cause and effect. He thinks that owing to a break-up in the southern ice-fields, and the liberation of great masses of ice which have come northwards, the great southern rain-belt has been thrown north, and thus brought *very heavy rains on* our coast.—*Cape Times*, December 27th, 1893."

REVIEW.

The Clyde Sea Area. By H. R. MILL, D.Sc., F.R.S.E. (Excerpt Trans. Roy. Soc. Edin.) 4to, 88 pages and 12 maps. R. Grant and Son, Edinburgh, 1892.

THIS is a full and very interesting account of the results obtained by Dr. Mill in what he has called the Clyde Sea Area, which may be defined as that portion of the sea on the West Coast of Scotland which is between the Peninsula of Kintyre and Ayrshire, in Lat. 55° N., and extends to the heads of Loch Fyne and Loch Long. This includes an area of nearly 1,200 square miles of water, while the area of the land draining towards it is about 3,300 square miles.

Dr. Mill seems to have spent a considerable portion of two years cruising about over this area in the steam yacht "Medusa," belonging to the Scottish Marine Station, and with apparatus either designed by himself or belonging to that establishment, taking thousands of measurements of temperature, specific gravity, and salinity, but apparently not paying much attention to either the direction or the force of the wind.

The paper before us deals chiefly with the specific gravity and salinity, its general object being to trace the rate of progress of the rain which falls on the land draining into the Clyde Sea Area, and on the water thereof, to its limit.

Dr. Mill spared no trouble; he took the Admiralty charts, and from them constructed a series of longitudinal and transverse sections of the various Lochs, so as to ascertain the cubic contents of each; he determined as nearly as practicable the fall of rain which had to be accounted for. (If anything, we think that his values are a little too high for the fall on the sea, but in the absence of actual knowledge, do not speak positively.) Then, by his determinations of specific gravity, and by chemical analysis, Dr. Mill gets out the proportion of fresh water to salt water in various parts of the district, and in different seasons. This problem is not an easy one. Dr. Mill himself finishes his paper with the following paragraph:—

"It is somewhat remarkable that so prolonged, widespread, and careful a set of analyses as those of Mr. Dickie do not show more direct relations with the remarkably contrasted physical conditions of the regions from which the samples worked upon were taken. I confess to much disappointment with the results; but, in the hope that others with greater skill or courage in the treatment of statistics than I possess may be induced to look into the matter, I am induced to publish my discussion of the work as far as it has gone."

Our impression is that Dr. Mill unduly depreciates his own abilities, and that the difficulties have nothing to do with statistics. We have heard of very similar discordances in attempts to estimate the amount of fresh and of salt water in the Thames. But even if this part of the paper be untrustworthy, there remains much that is interesting, instructive, and suggestive.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1893.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	81·6	6	35·3	24	67·9	49·1	47·8	71	123·4	30·9	1·07	10	4·6
Malta	98·8	25	66·5	6	87·8	72·3	67·5	68	147·9	60·0	·00	0	2·0
Cape of Good Hope	80·4	15	41·9	1	64·7	50·6	50·9	77	...	...	3·73	10	5·9
Mauritius	78·3	25	57·8	13	75·6	63·1	59·4	75	127·7	48·3	·91	16	5·7
Calcutta	89·6	6, 28	73·7	12	86·6	77·7	78·2	88	158·3	72·4	8·74	13	6·7
Bombay	86·7	12	73·9	23	84·5	76·1	74·4	83	139·0	71·0	7·54	24	7·3
Ceylon, Colombo	86·7	29	72·8	25	84·7	75·9	71·4	79	153·0	70·0	1·99	13	5·4
Melbourne	81·8	30	33·9	2	62·2	47·1	45·8	75	127·4	27·9	3·27	18	7·4
Adelaide	84·0	22	40·3	19	65·6	49·0	46·4	66	146·0	33·0	3·34	19	6·6
Sydney	84·0	23	43·4	2	67·3	51·5	47·9	68	137·3	33·7	1·60	15	3·0
Wellington	65·0	22*a*	36·0	30	59·2	48·5	47·3	79	123·0	27·0	5·97	21	5·2
Auckland	67·0	27	44·0	21	61·9	50·7	49·2	77	140·0	40·0	3·57	20	6·0
Jamaica, Kingston	91·3	12	71·0	26	89·1	73·7	72·6	81	...	...	2·72	6	5·6
Trinidad	92·0	1, 2	67·0	1	89·3	70·3	75·1	86	171·0	67·0	11·73	14	...
Toronto	79·1	19	36·2	26	66·4	48·4	49·9	75	...	30·2	1·25	12	5·0
New Brunswick, Fredericton	76·9	14	30·0	27	61·8	42·4	45·5	74	...	...	5·27	18	5·5
Manitoba, Winnipeg	86·6	12	21·7	26	67·1	42·4	...	...	...	...	·66	10	5·0
British Columbia, Esquimalt	70·6	6	40·2	12*b*	62·0	46·3	49·9	89	...	...	1·21	13	5·4

a And 26. *b* And 23, 30.

REMARKS.

MALTA.—The hottest month of the year, and hotter than any previous September in 10 years; also the only September in that period with total absence of rain. The high dew point made the weather very trying. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·3 below, dew point 0°·3 below, and rainfall ·53 in. below, their respective averages. Mean hourly velocity of wind 11·4 miles, or 0·7 mile below average; extremes, 26·1 on 1st, and 1·8 on 6th; prevailing direction, E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—L only was seen on the 29th. D. G. MANTELL.

Melbourne.—Hoar frost on the 2nd; hail on the 7th; heavy squalls on the 17th and 21st; lightning on the 11th; distant thunder on the 23rd and 24th; thunderstorms on the 25th and 30th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·2 above the average of 36 years. A very wet and cloudy month, the rainfall being 1·56 in. above the average. C. TODD, F.R.S.

Sydney.—Temperature 0°·7 above, humidity 2 below, and R 1·56 in. below, the average. H. C. RUSSELL, F.R.S.

Wellington.—Showery, unpleasant weather almost throughout the month. Prevailing winds N.W., frequently strong; thunder on the 10th; hail on the 29th and snow on the hills. Mean temp. 2°·9 above, and rainfall 1·71 in. above, their averages. R. B. GORE.

Auckland.—A showery month, but with no violent storms or other exceptional features. Rainfall about a quarter of an inch above the average. Mean temp. 1°·5 above the average; barometrical pressure much below. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Fair, with afternoon showers and thunder. Mean hourly velocity of wind 3·5 miles. ROBT. JOHNSTONE.

TRINIDAD.—*Rainfall* 4·20 in. above the average of 30 years, and only exceeded *in 1862, 1863, 1875,* and 1876. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	1·73	XI.	Rhayader, Nantgwillt..	7·00
,,	Birchington, Thor	1·25	,,	Lake Vyrnwy	11·08
,,	Hailsham	2·51	,,	Corwen, Rhug	4·25
,,	Ryde, Thornbrough	2·69	,,	Carnarvon, Cocksidia ...	3·41
,,	Emsworth, Redlands ...	2·08	,,	I. of Man, Douglas	5·66
,,	Alton, Ashdell.....	2·50	XII.	Stoneykirk, Ardwell Ho.	2·81
III.	Oxford, Magdalen Col...	1·41	,,	New Galloway, Glenlee	12·66
,,	Banbury, Bloxham	1·90	,,	Melrose, Abbey Gate...	6·72
,,	Northampton, Sedgebrook	1·99	XIII.	N. Esk Res. [Penicuick]	11·90
,,	Alconbury	1·18	,,	Edinburgh, Blacket Pl..	6·81
,,	Wisbech, Bank House..	1·09	XIV.	Glasgow, Queen's Park.	8·96
IV.	Southend	1·26	,,	Inverary, Newtown	14·83
,,	Harlow, Sheering	1·47	XV.	Islay, Gruinart School..	5·57
,,	Colchester, Lexden.....	1·23	XVI.	Dollar.....	8·63
,,	Rendlesham Hall	1·34	,,	Balquhidder, Stronvar..	16·79
,,	Diss	1·47	,,	Ballinluig	6·54
,,	Swaffham	1·19	,,	Dalnaspidal H.R.S. ...	14·82
V.	Salisbury, Alderbury...	1·94	XVII.	Keith H.R.S.	2·91
,,	Bishop's Cannings	2·69	,,	Forres H.R.S.	3·71
,,	Blandford, Whatcombe.	3·47	XVIII.	Fearn, Lower Pitkerrie.	4·72
,,	Ashburton, Holne Vic....	4·23	,,	Loch Shiel, Glenaladale	17·76
,,	Okehampton, Oaklands.	4·88	,,	N. Uist. Loch Maddy ...	7·91
,,	Hartland Abbey	3·35	,,	Invergarry	15·79
,,	Lynmouth, Glenthorne.	3·79	,,	Aviemore H.R.S.	6·45
,,	Probus, Lamellyn	2·38	,,	Loch Ness, Drumnadrochit	7·48
,,	Wellington, Sunnyside..	3·06	XIX.	Invershin	5·14
,,	Wincanton, Stowell Rec.	2·96	,,	Scourie	5·89
VI.	Clifton, Pembroke Road	3·99	,,	Watten H.R.S.	2·43
,,	Ross, The Graig	2·24	XX.	Dunmanway, Coolkelure	7·45
,,	Wem, Clive Vicarage ...	2·25	,,	Fermoy, Gas Works ...	2·14
,,	Cheadle, The Heath Ho.	2·86	,,	Killarney, Woodlawn ...	5·37
,,	Worcester, Diglis Lock	2·21	,,	Tipperary, Henry Street	2·10
,,	Coventry, Coundon	2·66	,,	Limerick, Kilcornan ...	2·43
VII.	Ketton Hall [Stamford]	1·94	,,	Ennis	3·94
,,	Grantham, Stainby	1·99	,,	Miltown Malbay.....	4·60
,,	Horncastle, Bucknall ...	...	XXI.	Gorey, Courtown House	1·82
,,	Worksop, Hodsck Priory	2·48	,,	Athlone, Twyford	3·85
VIII.	Neston, Hinderton	2·52	,,	Mullingar, Belvedere...	3·97
,,	Lancaster, Rose Bank...	5·24	,,	Longford, Currygrane...	3·88
,,	Broughton-in-Furness..	8·41	XXII.	Galway, Queen's Coll...	5·55
,,	Ripon, Mickley	5·19	,,	Crossmolina, Enniscoe..	8·63
IX.	Scarborough, South Cliff	2·55	,,	Collooney, Markree Obs.	5·67
,,	East Layton [Darlington]	4·52	,,	Ballinamore, Lawderdale	4·80
,,	Middleton, Mickleton..	6·77	XXIII.	Lough Sheelin, Arley ..	4·11
,,	Haltwhistle, Unthank..	7·33	,,	Warrenpoint	3·78
X.	Bamburgh.....	3·36	,,	Seaforde	3·28
,,	Newton Reigny	...	,,	Belfast, Springfield	4·33
XI.	Llanfrechfa Grange	5·16	,,	Bushmills, Dundarave...	5·20
,,	Llandovery	6·62	,,	Stewartstown	3·92
,,	Castle Malgwyn	2·94	,,	Buncrana	5·36
,,	*Builth, Abergwessin Vic.*	...	,,	Lough Swilly, Carrablagh	7·20

FEBRUARY, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	In Shade.
			inches.	inches.	in.							
I.	ENGLAND.	London (Camden Square) ...	1·75	— ·13	·41	17	16	56·4	7	23·3	19	8
II.		Maidstone (Hunton Court)...	1·63	— ·17	·26	17	13	...	...	...	...	...
„		Strathfield Turgiss	2·06	+ ·06	·67	17	18	57·1	2	20·1	21	8
III.		Hitchin	1·73	— ·02	·58	17	15	53·0	7, 26	19·0	18	9
„		Winslow (Addington)	1·72	— ·44	·68	17	16	55·0	27	20·0	19*b*	11
IV.		Bury St. Edmunds (Westley)	1·73	+ ·17	·39	25	12	55·0	8	22·0	23	...
„		Norwich (Brundall)	1·09	...	·23	25	14	57·0	7	22·6	23	11
V.		Weymouth(LangtonHerring)	2·56	— ·04	1·11	17	17	52·0	11	25·0	19*b*	5
„		Torquay (Cary Green)	1·72	...	·23	23	18	53·9	27	27·8	21	3
„		Polapit Tamar [Launceston]..	2·34	— ·93	·47	17	17	61·0	8	28·0	21	4
VI.		Stroud (Upfield)	2·44	— ·12	1·00	17	18	54·0	27	24·0	20	8
„		ChurchStretton(Woolstaston)	3·01	+ ·56	·57	17	18	54·0	7	22·0	19	8
„		Tenbury (Orleton)	2·43	— ·05	·81	17	16	56·0	7, 26	20·5	21	10
VII.		Leicester (Barkby)	1·77	— ·04	·47	17	15	59·0	7	15·0	19*c*	17
„		Boston	1·14	— ·54	·40	17	9	60·0	7	20·0	22	12
„		Hesley Hall [Tickhill].....	2·72	+ 1·22	1·13	17	15	59·0	7	...	...	12
VIII.		Manchester(PlymouthGrove)	4·49	+ 2·44	·81	10	20	55·0	7	23·0	19	9
IX.		Wetherby (Ribston Hall) ...	3·66	+ 2·08	1·02	18	12	...	...	...	...	...
„		Skipton (Arncliffe)	10·40	+ 5·71	1·28	10	24	...	...	...	...	...
„		Hull (PearsonPark)	2·68	+ ·88	·63	16	16	59·0	7	24·0	20	13
X.		Newcastle (Town Moor)	2·88	+ 1·48	·97	16	15	...	...	...	...	...
„		Borrowdale (Seathwaite).....	25·91	+13·27	3·64	6	23	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·06	+ ·87	·74	17	21	...	...	...	...	...
„		Haverfordwest	3·33	— ·79	·62	17	22	53·1	8	21·1	21	6
„		Aberystwith, Gogerddan.....	4·16	+ ·90	·80	25	18	52·0	16	17·0	20	9
„		Llandudno.....	3·13	+ 1·21	·57	16	19	...	...	...	...	...
XII.	SCOTLAND.	Cargen [Dumfries]	9·73	+ 6·08	1·52	16	22	53·4	7	24·0	14	6
„		Jedburgh (Sunnyside).....	4·20	+ 2·69	·77	16	18	56·0	25	23·0	14	11
XIV.		Old Cumnock	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	11·74	+ 6·55	1·55	6	26	...	...	19·0	13	8
„		Mull (Quinish).....	7·53	+ 2·06	·81	28	27	...	...	...	...	...
„		Loch Leven Sluices	9·20	+ 6·45	1·60	12	16	...	...	...	...	...
XVI.		Dundee (Eastern Necropolis)	4·45	+ 2·35	·85	16	22	54·0	7	22·4	1	9
„		Braemar	5·68	+ 2·32	·85	28	23	49·2	6, 7	3·8	15	15
XVII.		Aberdeen (Cranford)	2·91	...	·81	16	16	53·0	6	28·0	13	9
„		Strathconan [Beauly]	12·19	+7·48	1·40	7	17	...	...	...	...	...
XVIII		Glencarron Lodge.....	14·93	...	1·85	11	26	49·4	6	13·9	14	12
„		Cawdor [Nairn]	5·11	+ 2·88	·89	6	23	...	...	...	...	...
XIX.		Dunrobin	5·23	+ 3·14	·95	11	19	51·2	4	21·8	15	5
„		S. Ronaldsay (Roeberry).....	3·25	+ ·61	·85	11	23	49·0	6	28·0	11	10
XX.	IRELAND.	Darrynane Abbey.....	2·51	...	·43	15	23	...	...	...	...	...
„		Waterford (Brook Lodge) ...	2·43	— 1·65	·48	27	19	54·0	7	24·0	21	5
„		O'Briensbridge (Ross)	4·06	...	·48	24	20	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	2·72	— ·36	·46	28	22	...	...	...	...	...
„		Dublin (FitzWilliam Square)	1·90	— ·45	·36	10	16	58·6	7	31·6	1	2
XXII.		Ballinasloe	4·69	+ 1·91	1·00	10	23	53·0	6*a*	33·0	1*d*	...
„		Clifden (Kylemore)	10·76	...	1·03	9	25	...	...	...	...	...
XXIII		Waringstown	2·81	+ ·36	·79	10	17	56·0	1, 7	27·0	12*e*	9
„		Londonderry (Creggan Res.).	5·59	+ 2·56	1·02	10	26	...	...	...	...	...
„		*Omagh (Edenfel)*	5·18	+ 2·49	1·12	10	22	52·0	28	28·0	17	7

a And 7, 26. *b* **And 21, 22.** *c* **And 20.** *d* **And 11, 18.** *e* **And 18.**
+Shows that **the fall was above the average ; —that it was below it.**

METEOROLOGICAL NOTES ON FEBRUARY, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A showery month, but with about the average rainfall, and mild, with the exception of one or two cold periods, especially about the 21st and 22nd. From the 6th to the 11th, and from 25th to the close, the weather was very rough and unsettled. Hazel in flower on 1st.

ADDINGTON.—The month was noted for heavy wind storms, often lasting for a long time, particularly that of the 10th, 11th, and 12th. The rainfall on the 17th (0·68 in.) caused the brook to overflow the meadows, the first time for many months. A sharp spell of frost set in on the 19th, lasting four days, the ther. on grass falling to 15° on the 19th. Aurora on the 28th.

BURY ST. EDMUNDS.—A cold spell occurred from the 18th to the 24th, the rest of the month being mild. Very windy, especially at night. Fine aurora on the evening of the 28th. S on 28th.

NORWICH, BRUNDALL.—The first fortnight was very mild and boisterous, with scarcely any frost. Severe gales on the 6th, 7th, 10th, 11th, and 12th, that on the 11th being exceptionally violent. Max. temp. above 50° daily (with one exception) from 1st to 11th. The third week bright, but colder, with frosty mornings. The close of the month again stormy and mild. The earlier spring flowers quite as forward as in 1893. S on 28th, and bright white aurora in evening.

LANGTON HERRING.—With the exception of a cold snap from the 18th to the 23rd, the month was uniformly mild, the variations of temp. being very slight, and the mean at 9 a.m. 1°·2 above the average of 23 years. Temp. fell to 25° on the 19th, 21st, and 22nd, to 26° on the 20th, and to 27° on the 23rd, but on no other days was there frost. Fogs on the 5th, 6th, 9th, and 26th. Very high wind on the 11th.

TORQUAY, CARY GREEN.—Duration of sunshine 89 hours, or 8 hours in excess of the average. Mean temp. 44°·7, or 2°·3 above the average. Rainfall 1·05 inches less than the average.

POLAPIT TAMAR.—Gales or high winds on 6th, 7th, 9th, 10th, and 12th, and heavy gale at night, with H, on the 11th.

STROUD, UPFIELD.—S.W. gales on the 6th, 7th, 10th, and 11th.

WOOLSTASTON.—A very stormy month. The gale on the 11th was most destructive, wrecking chimneys, roofs, and ricks in all directions, and throwing down a large portion of a very fine church spire. A brilliant display of aurora occurred on the 28th from about 7 to 9 p.m. Gales on the 6th, 7th, and 23rd. Mean temp. 40°·4. S fell on the 12th and 17th.

ORLETON, TENBURY.—With the exception of 7 days from 18th to 24th inclusive, a fine, warm month; the first fortnight unusually so. A great gale occurred at night on the 11th, doing much damage. Fog on 15th and 22nd. Mean temp. rather more than two degrees above the average of 33 years.

LEICESTER, BARKBY.—A month of fine open weather, except from 17th to 24th. Hurricane on 11th. Mean temp. 39°·4. Grass has grown almost all through the winter. Water is still deficient.

MANCHESTER.—Slight fall of S on the 1st, followed by a week of fine weather. On the 11th a great storm of wind. Slight H showers on the 12th and 13th. Dense fog up to noon on the 22nd. Mean temp. 40°·9.

HULL, PEARSON PARK.—Stormy on the 6th, 7th, 10th, 11th, 12th, and 23rd.

SEATHWAITE.—Falls of R exceeding an inch occurred on 12 days, exceeding two inches on two days, and exceeding three inches on one day. S 1½ inches deep on 13th.

WALES.

HAVERFORDWEST.—The general characteristic of February was mildness and continuous wet, although the amount of R was not excessive. There was also

a constant succession of gales, some of them of great strength and long duration. From the 19th to the 23rd keen frost prevailed, which interposed a salutary check on the exuberant and precocious advance of vegetation. On 28th a splendid meteor was seen to N. at 7.20 p.m., and bright aurora from 7 to 8.30 p.m. Prevailing winds S., S.W. and N.W.

GOGERDDAN.—Very stormy throughout the month, with gales from the W. and N.W. Very little sunshine.

SCOTLAND.

CARGEN.—Another very stormy and unsettled month, the fluctuations in pressure being on several occasions very marked, on one occasion upwards of an inch in 24 hours. A good deal of damage was done to trees, &c., in the district. The R was excessive, being the heaviest recorded in February in the 34 years since observations commenced. On three days the fall exceeded an inch. On only three occasions during the above period has the amount of R been exceeded in any month. Extensive flooding and much damage has occurred in many parts of the district. The mean temp. of the month is a little over 1°·5 above the average. Sunshine little more than half the average duration. Heavy gale on the 11th, S showers on the 12th and 24th.

JEDBURGH.—The weather was most unsettled, extreme changes often occurred several times during the day. On high ground much S fell, and the distant hills were all white, but on lower lying ground it melted the day it fell. Still out-door work went on unchecked. High wind on 6th, 7th and 11th.

MULL, QUINISH.—A month of almost incessant gales from all qaarters. Violent S squalls with T and L on 9th, 10th, 24th and 27th.

BRAEMAR.—Aurora on the 21st and 28th. L on the 26th, 27th and 28th.

ROEBERRY.—A very coarse month throughout, almost one continued gale from S.W. to W. Mean temp. 38°·2.

IRELAND.

O'BRIENSBRIDGE, ROSS.—S.W. gales were frequent during the month. A week of bright cold bracing weather occurred from 14th to 21st, the remainder of the month was wet. T and L on 27th.

DUBLIN.—An open, windy, showery month. Until the 14th and after the 22nd deep depressions passed in rapid succession north eastwards, causing strong S.W. and W. gales, and frequent falls of R, H and sleet. Conditions were, for the most part, anticyclonic from the 14th to the 22nd, so that fog and frost were prevalent in that central period of the month. The mean temp. (44°·9) was 2°·1 above the average. S or sleet fell on two days, and H on four days. Fogs occurred on eight days. High winds were noted on 17 days, reaching the force of a gale on eight. L on the 11th. Aurora on the 23rd and 25th.

EDENFEL.—Every concomitant of bad weather prevailed with but little intermission during the entire month. Extremely unsteady pressure, equally unsteady temp., though but little frost; gales, squalls, sleet, H and heavy drenching rains and winter L in daily and nightly succession. The total rainfall of the month and also of January was double the average, amounting for both to 11·82 in., the heaviest for at least 30 years.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

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THE CLIMATE OF ODESSA.*

PROF. KLOSSOVSKY has not been so considerate towards his western friends as usual. If we remember correctly he generally prints his papers in Russian, *and* French or German, or gives an epitome in one of those languages. The present important paper is wholly in Russian, with the exception of half the title page, the table of contents, and the list of numerical tables. As our knowledge of the Russian language is extremely slight, we cannot give a critical notice, but will briefly indicate the scope of the work. Section I. describes the position of the observatory, and gives a list of observations made in the town from 1839 to 1892 (there appear to have been some 1820–30, but we do not see the results in the present paper). Section II. deals exhaustively with the temperature, especially as regards the period (1866–92) during which the observatory has been fully equipped, and also compares the values for Odessa with those for other places. For an obvious reason we do not say more respecting this section than that it has evidently been worked out with great care; some of the principal features will be found indicated in the table at the end of this notice. In Section III. Professor Klossovsky deals very similarly with rain, snow and hail—comparing the mean at Odessa (16·98 in.) with that at other stations, of which we may quote a few:—Astrakhan, 7·19 in.; Baku, 9·93 in.; Sevastopol, 15·15 in.; Archangel, 15·61 in., and Moscow, 21·11 in. Then he takes out the extreme fall in each month at Odessa; the wettest month being June, 1886, with 6·58 in., and the driest, September, 1892, absolutely rainless. As regards the yearly totals, he gives—

		Depth. in.	Ratio.
Wettest.....	1875	24·62	145
Mean	1866–92	16·98	100
Driest	1872	9·39	55

The wettest year agrees absolutely with the value assigned by Mr. Binnie and Mr. Symons; the driest year is, relatively to the mean, decidedly low.

Section IV. deals with humidity, cloud, fog, and evaporation—the

* Le Climat d'Odessa d'après les observations de l'observatoire Météorologique de l'Université Impériale d'Odessa, par A. Klossovsky. Odessa, Franzow, 1893. 4to, 72 pages, 1 plate.

last (we believe) as recorded by Wild's vaporimeter. The yearly totals are :—

		in.			in.
1886	.....	20·10	1890	.....	23·36
1887	.....	23·55	1891	.....	25·95
1888	.....	18·63	1892	.....	27·06
1889	.....	incomplete.			

the average being 22·43 in.

Sections V. to VIII. deal respectively with barometric pressure, prevalent winds, the physical features of the Black Sea, and with terrestrial magnetism.

Mean and extreme values for Odessa (1866-92.)

Lat. 46° 28′ 36″ N. Lon. 30° 45′ 33″ E. Altitude 180 ft.

	Temperature in Shade.				Rainfall.		Cloud.	Humidity.
	Mean.	Max.	Min.	Range.	Depth. in.	Days.	Mean. 0-10.	Mean.
	°	°	°	°				
Jan....	26·4	54·9	— 8·3	63·2	1·00	7	7·6	89
Feb....	27·5	58·5	—18·8	77·3	·81	7	7·1	86
March	36·0	69·8	— 0·4	70·2	1·29	9	6·9	82
April..	48·2	74·5	24·6	49·9	1·09	7	5·5	73
May...	61·0	93·6	34·2	59·4	1·39	8	4·7	67
June..	69·3	92·5	50·2	42·3	2·31	8	4·5	64
July...	73·4	95·4	53·6	41·8	1·92	7	3·8	61
Aug..	71·6	93·6	48·7	44·9	1·27	5	3·2	61
Sept...	63·0	89·6	33·4	56·2	1·36	5	3·7	67
Oct. ...	52·3	85·6	21·6	64·0	1·38	6	5·4	78
Nov. ..	41·5	66·2	9·9	56·3	1·61	9	7·3	84
Dec....	31·6	60·1	— 6·9	67·0	1·55	9	7·2	87
Year.	50·2	95·4	—18·8	114·2	16·98	87	5·7	75

[Note.—The max. and min. are not from self-registering thermometers, but the extreme at any observation hour ; the full range would therefore be greater.]

Yearly total Rainfall at Odessa, 1841-92.

Years.	Depth. in.	Years.	Depth. in.	Years.	Depth. in.	Years.	Depth. in.	Years.	Depth. in.
1840...	—	1850...	13·46	1860...	19·14	1870...	22·03	1880...	18·21
1841...	—	1851...	12·04	1861...	15·04	1871...	15·21	1881...	22·11
1842...	10·43	1852...	16·73	1862...	—	1872...	9·39	1882...	17·71
1843...	14·82	1853...	17·72	1863...	—	1873...	9·44	1883...	11·27
1844...	11·83	1854...	15·18	1864...	—	1874...	17·68	1884...	19·11
1845...	16·85	1855...	—	1865...	—	1875...	24·62	1885...	15·80
1846...	10·99	1856...	14·92	1866...	—	1876...	19·26	1886...	19·07
1847...	13·50	1857...	11·93	1867...	10·57	1877...	22·34	1887...	18·88
1848...	11·59	1858...	19·92	1868...	9·99	1878...	22·74	1888...	18·10
1849...	17·62	1859...	—	1869...	15·95	1879...	22·97	1889...	20·75
	13·45		15·24		14·14		18·57		18·10

Years.		in.
1890	.....	16·28
1891	.....	12·65
1892	.....	14·26
		14·40

[Note.—It will be seen that the total is not given for 1866, there being no record for January. As the other eleven months of that year were mostly very

dry, the mean in the previous table for the 27 years, 1866–92 (16·98 in.), is slightly (0·19 in.) less than the mean of the 26 years, 1867-92, which is 17·17 in. The early observations gave generally about three inches less than the later ones (possibly the gauge was higher above the ground), and there are small values in winter, which may indicate that at that time snow was not carefully measured.]

We have doubtless not done justice to the paper, but we have said enough to indicate what a mass of information it contains.

IRIDESCENCE ON THE ENGLISH LAKES.

To the Editor of the Meteorological Magazine.

SIR,—I observed a phenomenon yesterday which was strange to me and which may interest your readers.

I was on Windermere about 11 a.m. when I noticed on the surface of the water about a mile north of where I was, a narrow streak of light, brilliantly coloured in rainbow tints. It lay across the lake apparently in a straight line, the blue end towards the east, the red to the west, nearly extending to the shore on each side, but neither actually reaching it. The red end terminated somewhat abruptly. The blue was more elongated, and became fainter towards the extremity.

The sky was practically cloudless, but the atmosphere was slightly hazy, not enough, however, to prevent the further shore of the lake, about five miles distant, from being distinctly seen over and beyond the line of light.

The phenomenon lasted about ten minutes and then gradually faded away. There was not a breath of wind at the time.

I am, yours faithfully,

GEO. CREWDSON.

St. Mary's Vicarage, Windermere, March 30th, 1894.

The above account is very interesting. Some time since we investigated the Floating Island,* and Professor Meldola† explained the production of the gases which floated it. We now have another phenomenon, or perhaps two considering the widely different explanations. The first we reprint verbatim from the *Edinburgh New Phil. Journal* for July, 1853.

Singular Iridescent Phenomenon seen on Windermere Lake, October 24th, 1851. By J. F. MILLER, Esq.

On the 24th inst. (October) a very remarkable iridescent appearance was seen on Windermere Lake by a gentleman (J. C. Mounsey, Sunderland), from whose written description I have gathered the following particulars:—

"The morning was very misty, and the barometer high (30·35 Whitehaven); between 10 and 11 a.m. the mist cleared off, the sky became cloudless, and the

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* "The Floating Island in Derwentwater; its History and Mystery," by G. J. Symons, F.R.S. 4to, cloth. Stanford, Cockspur-street.

† *Met. Mag.*, Nov., 1889.

air calm, the lake being of a glassy smoothness. At 11 we went on the lake, and, in about half an hour I observed brilliant prismatic colours on the water, near the shore, say half a mile or more distant, but no appearance of a bow. I rowed towards the spot, and in doing so, the colours increased in extent and brilliancy.

There were two bows, which resembled ordinary rainbows inverted; both were exceedingly brilliant at the extremities, and became gradually fainter as they receded from the shore.

"The outer bow came completely down to the boat, which appeared to prevent our seeing the crown of the arch; its extremities also proceeded from the shore, and its centre was apparently under the feet of the spectator. In both bows, the red was on the outside and the violet on the inside, and, in both, the light and colours were most brilliant and distinct at the extremities or points of convergence at the water's edge. I am certain there was no rainbow in the sky at the time, neither was there any solar halo or any other phenomenon in the air that I observed, of which this could be the reflection. I observed that wherever the prismatic phenomenon shewed itself, there was a sort of scum on the water, as if there was some fine dust or bubbles on the surface. I put my finger into the water and found it so dirty as to leave a distinct mark behind, which leads me to think that what I at first took to be small bubbles must have been some sort of dust. Whatever it was, it appeared to me to be the cause of the iridescence, as wherever it was lost the bows disappeared.

"The bows were visible about an hour, and in looking at them the sun was of course directly behind the spectator.

"The boatmen say they have sometimes (though very rarely) seen a similar phenomenon after the disappearance of a mist from the surface of the water." At Whitehaven, the sky was also cloudless, but in the evening the air was misty.

Dr. Davy considers that the carbonaceous deposit or soot-like film, occasionally observed on the lakes of Westmoreland, is really of the nature of soot, derived from the adjoining manufacturing districts, wafted thither by the wind, and falling with the mist or light rain. The film burns in the same manner as soot, sinks when wet in water, imparts a brownish hue to transmitted light, and under the microscope, appears to be composed of particles more or less irregular in form, varying in size from 1-4000th to 1-1000th of an inch. Dr. D. further thinks that the precipitation is an ordinary, rather than an uncommon, occurrence here, as is shewn by the discoloration of the sheep of the country, especially after exposure for many months on the higher fells. Seen on the mountain pastures, or when driven into the lower meadows in the early spring, their coats are of so dark a hue, as to resemble closely those of their fellows fed in the most smoky precincts of our great towns; and on examination, the colouring matter staining the fleece, is found to be similar to that of the black film of the lakes and tarns, and in brief, it is essentially soot.*

J. F. MILLER.

Observatory, Whitehaven, April, 1853.

On a calm sunny autumn morning about 20 years ago we were rowing, or perhaps it would be the actual fact to say floating, on Derwentwater, when we suddenly noticed about a quarter of a mile to the north, a long line of intense prismatic colours on the surface of the lake, and stretching from W. to E. We kept our boat nearly

*Edinburgh Philosophical Journal for January, 1852, p. 64, and private letter from Dr. Davy.

stationary, and enjoyed the lovely colouring until, in about ten minutes, it faded away. The line of colour was much more intense than that of any rainbow, halo, or corona. We are not competent to decide the cause, but our impression was that, being nearly level with the water (which assuredly had no smoke upon it) the distant ripples were so foreshortened that they acted like the diamond ruling on a diffraction grating and broke up the bright sunlight into a natural spectrum.

We shall be glad if some of our readers will tell us whether this explanation is in accordance with the laws of optics, or if not, what is the true explanation. It seems to us that the Rev. G. Grewdson saw the same phenomenon as we did, but that Dr. Miller's was scum iridescence. —*Ed.*

SUNSPOTS AND AIR TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—I am glad that "W. E." has taken up this question, and I trust his re-presentation of the facts will be carefully considered. I may be permitted to at least doubt whether he has yet "probed the matter as completely as possible."

It occurred to me that some fresh light might be had by going through all the months of what we may call the "summer half" (April to September) concerned in this inquiry (414 in all), and seeing how many were above and how many below average.

The result is curious :—

(1.) *Minimum Sunspot division.*

	April.	May.	June.	July.	Aug.	Sept.		
a. Above average ...	15	20	19	11	17	18	= 100	= 216
b. Below average ...	20	16	17	22	19	18	= 112	
Average	1	...	...	3	..	...	= 4	

(2.) *Maximum Sunspot division.*

a. Above average ...	13	14	14	16	16	12	= 85	= 198
b. Below average ...	19	17	19	17	17	21	= 110	
Average	1	2	...	...	...	...	= 3	

Thus there is a majority of months below average in the minimum division as well as in the maximum. But a majority of months below average also appears if we take the whole 130 years. On the other hand, it may be said, that the number of months *above* average in (1) is a somewhat larger proportion of the total in (1) than the number in (2) is of the total in (2); and the number *below* average in (2) a larger proportion of the total in (2) than is the case in (1); also that in (2) *all* the months show a greater number of cases below average than above; whereas in (1) this happens in only three months. But I do not lay stress on these things.

In seeking proof of an influence of the sunspot cycle on air temperature, it seemed to me that we might be more likely to find it, or might find it more pronounced in the summer half than in the other. "W. E." *sees no reason for* excluding the winter half, and it is

assumed, I rather think, that the effect on the two halves must be similar in kind, so that if, *e.g.*, we find a warmer summer half with sunspot minimum, we should then find also a milder winter half. Is this warranted? The weather-problem is a very complex one. What if we found the two halves to vary with *opposite* phases, so that about minimum sunspots (from whatever cause) they got further apart, while about maximum they drew nearer again? The contrast between the two being intensified about the time of minima. I am inclined to think there *is* something of this nature, and would now, with your permission, give some figures which seem to point that way.

Consider the mean temperature of the summer half and that of the winter half (by which latter will here be meant the first quarter plus the last quarter of each year, not the months October to March in two years.) We may first take Dr. Buchan's entire table, then the data since 1841 alone (of which, I suppose, we may feel more sure). Put down in one column the values for the minimum sunspot years; in another, those for the *first* year after minimum; in another, those for the *second*; then those for the *third*. Do the same with the maximum sunspot years, and take averages. (Those years are selected because of possible lagging effect.) In this way I find as follows:—

I. *Summer half.*

1. ENTIRE SERIES FROM 1763.

	Min. or Max. year.	Average Monthly Temperature. 1	2	3
		°	°	°
a. Min. group.....	58·24	58·17	58·06	58·43
b. Max. group ...	57·29	57·62	57·61	58·18
Relation of *a* to *b*	+·95	+·55	+·45	+·25

2. SERIES FROM 1841.

a. Min. group.....	58·06	58·44	57·78	58·96
b. Max. group ...	57·20	57·90	57·52	57·40
Relation of *a* to *b*	+·86	+·54	+·26	+1·56

II. *Winter half (first quarter and last quarter).*

1. ENTIRE SERIES FROM 1763.

a. Min. group.....	42·08	42·42	42·08	42·36
b. Max. group ...	42·11	42·50	42·55	42·44
Relation of *a* to *b*	—·03	—·08	—·47	—·08

2. SERIES FROM 1841.

a. Min. group.....	41·78	41·72	41·78	41·72
b. Max. group ...	41·82	42·95	43·05	42·75
Relation of *a* to *b*	—·04	—1·23	—1·27	—1·03

We thus find in each case an excess in the summer half with sunspot minima, and a defect in the winter half.

Another view of the matter is this: consider the difference in mean temperature between the two halves since 1841. Smooth the series by means of five year averages. The resulting curve corres-

ponds very fairly with the sunspot curve, showing maxima in 1844 (sunspot min. 1843), in 1857 (min. 1856), in 1869 (min. 1867), in 1879 (min. 1878), and 1888 (min. 1889.)

To some minds, possibly, such opposite behaviour of the summer and winter halves might appear to tell against the idea of sunspot influence. I do not see why it should. Possibly, again, by some method of analysis like that he has applied, "W. E." might find what he would consider fatal differences. Such must be weighed with the evidence of the undivided series, and the consensus above shown. I would here merely remark on the lessened evidential value of half a numerical series of the kind we deal with, as compared with the whole. And the more you divide, the more weight you give to those accidental variations which it is our object in taking as long a series as possible to neutralise. Perhaps, after all, twelve sunspot waves are too few to give satisfactory results.

As to differences between max. and min. years being small, I would ask, Are we entitled, by the nature of the case, to expect large differences?

Hoping I have not transgressed in the length of this letter,

I am, yours faithfully, A. B. M.

NOTE.—In a list of years of sunspot maxima given recently (*Met. Mag.*, vol. xxviii., p. 151) is the year 1788. I have here substituted 1787, thus conforming to Wolf throughout (whose figures for those two years are very near each other—viz., 130·9 and 132·0.)

A ROUGH WINTER ON BEN NEVIS.

To the Editor of the Meteorological Magazine.

SIR,—The past winter has been so exceptionally wet and sunless over the more northern portion of the British Isles, that a summary of the meteorological conditions experienced at the Ben Nevis Observatory (4,407 feet above the level of the sea) may be of interest as showing how bad British weather can really be. We have extracted from the official returns in possession of the Scottish Meteorological Society the following particulars relative to rainfall and bright sunshine for the four months, November 15th, 1893, to March 14th, 1894—119 days in all:—

Rainfall (including melted snow)	104·39 ins.
No. of days ·01 in. or more fell	110
,, ,, 1·00 ,, ,, ...	38
Total bright sunshine	23·7 hrs.
Sunless days	107

From November 22nd, 1893, to February 13th, 1894, the bright sunshine recorded amounted to only four hours, December being sunless, except for one hour on the 1st. The only fine day during the four months was February 14th, when eight hours sunshine was registered. Needless to say, the mountain was rarely free from mist during the above long period.

I am, yours very truly, R. C. MOSSMAN.

10, Blacket-place, Edinburgh, April 3rd.

THE AURORA OF FEBRUARY 28TH.

To The Editor of the Meterological Magazine.

SIR,—On p. 21 Mr. Ryves suggests the possibility of computing the altitude of the aurora of the 28th ult., but unfortunately has himself not adopted the suggestion made in your magazine to secure synchronous observations, that is, of observing at the exact half-hours, see vol. vi., pp. 223, 224, and vol. xxvii, p. 121. He, however, describes the movement of the arches as steady, and if he is correct in that, then the omission will be of less consequence. In looking at my notes I find the statement that at 6.46 p.m. south of the main arch, which was always north of the Zenith, there were two partial ones; this looks promising for ascertaining the height, as Mr. Ryves also describes two; but unfortunately within two minutes later I observed there were three partial arches, and later on there continued to be at least three. I have not mentioned in my notes more than that; but as they were so imperfect, it was difficult at any moment to say how many there were—it is possible there might be more.

It is not unreasonable to suppose that the most southern arch seen here was also the most southern one that Mr. Ryves saw from Stoke, in which case it might be possible to calculate the heights; if he incline to do this, I will send him a copy of my observations, unless he prefer to accept the suggestion in the *Meteorological Magazine*, vol. xxvii, p. 122, for me to send both his and my observations to Dr. Veeder for his calculation. T. W. BACKHOUSE.

Sunderland, March 21st, 1894.

To the Editor of the Meteorological Magazine.

SIR,—In my account of the aurora of Feb. 28th, which appeared in your Magazine for March, I find that the values of the westerly and southerly movements of the luminous bands are erroneously given. Through an inadvertence in transcribing the fair copy from the rough notes, jotted down during the occurrence of the aurora, the values of the two movements were transposed, and instead of "60° in 35 minutes S., and 10° in 20 minutes W.," should have been "60° in 35 minutes W., and 10° in 20 minutes S." The figures did not strike me as having any particular significance at the time, but it is interesting to find that when the resultant of the two movements is worked out, it gives a combined movement in a direction about at right angles to the magnetic meridian.

Another fine aurora was well observed here on the evening of Friday, March 30th. There were no luminous bands on this occasion, but in other respects the spectacle presented (between 10 and 11 p.m.) was as fine as on the 28th, if not finer. At 10.30 p.m., brilliant coloured streamers, shooting up from the main arc in the north, and diverging in the usual fan-like form, filled the whole of the northern sky, and at 10.35 extended some distance beyond a line cutting the zenith and reaching the E. and W. horizons.

G. T. RYVES, F.R.Met.Soc.

Tean Vicarage, Stoke-on-Trent, April 4th, 1894.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday, March the 21st, at the Institution of Civil Engineers, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. H. C. Kiddle and Mr. S. R. Lowcock, Assoc.M.Inst.C.E., were elected Fellows of the Society.

Mr. W. H. Dines read a paper on the "Relation between the Mean Quarterly Temperature and the Death Rate." The Registrar-General's quarterly returns for the whole of England since 1862, were taken by the author, and the number of deaths in each quarter expressed as a departure per thousand from that particular quarter's average; the value so obtained being placed side by side with the corresponding departure of the temperature at Greenwich from its mean value.

The Registrar-General's returns relate to the civil quarter (January-March, &c.), but the temperature was taken for the seasonal quarter (December-February, &c.), as the cause must precede the effect. Had the civil instead of the seasonal quarter been taken, the results would have been substantially the same.

In the winter quarter the rule seems to be that a cold winter is unhealthy and a warm winter healthy. Like signs occur together, that is a + with a +, or a − with a −, twelve times, and unlike signs sixteen times, the remaining four being instances in which an exact average value occurs, which cannot be called either *plus* or *minus*. Thus out of 28 winters we have 12 exceptions to the rule. The exceptionally mild winters of 1866 and 1883 were unhealthy, and those of 1863 and 1872 had an average death rate. The exceptionally cold winters of 1881 and 1893 were exceptionally healthy, and those of 1880, 1887, 1888 and 1891 had a nearly average rate. With the exception of 1813, 1891 seems to have been the coldest winter of this century, and the fact that such a winter had an average death rate proves that prolonged cold is not necessarily prejudicial to health. This is the more remarkable, for 1891 was notorious for the number of its fogs.

In the summer quarter there is a marked relation between the temperature and the death rate. A hot summer is always unhealthy and a cold summer healthy. We have 22 like signs occurring together and 7 unlike.

The two summers notorious for cold, viz.: 1862 and 1879, are the two healthiest summers in the list. The hottest summer, 1868, is also the most unhealthy. Marked instances of the rule occur in 1863, 1867, 1868, 1878, 1879, 1884, 1888, 1891, 1892, and 1893, each of these being an exceptional summer accompanied by an exceptional death rate.

The excessive mortality in a hot summer is partly caused by the deaths of children under 5 years of age by diarrhœa, but even if all returns from this disease were excluded, the rule given above would hold.

It does not seem possible to deduce from the figures even the semblance of any relation between the two quantities for the spring and autumn quarters.

Absence of daylight means the increased use of artificial light, and in as far as the contamination of the air is concerned, one common gas burner is equivalent to four or five adults. The way in which overcrowding affects the death rate is well known; and there can be little doubt that, with the utter indifference to proper ventilation that prevails, most of our population live in the winter in air that is greatly overcharged with carbonic acid. This is a possible explanation of the higher winter death rate, although it may perhaps be due to the direct absence of sunlight. The question is very important, for if my conclusion be correct, the general introduction of good ventilation, or the use of the electric light in the place of gas or lamps, would greatly reduce the rate; whereas, if it be due to temperature or absence of sunlight, it is clear that no human agency can alter it.

The paper was followed by a prolonged discussion.

Dr. C. Theodore Williams suggested (in a letter) that the results would be materially affected if, in addition to heat and cold, other elements of climate were discussed, and also that epidemics would mask the effect of weather.

Dr. Robert Barnes referred to the effect of moisture and to the unfavourableness of the winter for outdoor exercise, and enlarged upon the enormous importance of sunshine.

Dr. Buchan thought that a weekly comparison would give better results, mentioning the immediate effect of hot summer weather and of sudden changes in winter, and pointing out that raw cold, with a temp. about 32°, is most detrimental, while colder and drier weather is favourable. He also questioned the advisability of comparing periods which were not synchronous, as most diseases do not take a month to kill.

Mr. Brodie objected to the use of Greenwich temperatures for comparison with England generally, and to the use of non-synchronous periods.

Dr. Marcet referred to the extreme unhealthiness of temp. just above 32°, illustrating it by the exodus from mountain sanitaria when the snow melts; he also mentioned the great strain endured in such polar expeditions as Dr. Nansen's, where exposure to extreme cold is prolonged for several years.

Mr. Symons quoted the late Dr. Rae as a standing example of the prolonged extreme cold that could be borne with apparent immunity, and thought that the retardation of one month adopted by Mr. Dines between the temp. and death rate, was not at all too great to allow for the disease to run its course and the death to be registered.

Mr. Dines, in reply, said that he began a weekly comparison, but could get no result; that he found the maximum death rate from diarrhœa occurred three weeks after the maximum temp., and that therefore he considered a month not too long to allow for diseases

in general; that he took the Greenwich temperature as simplest, and believed that it gave fair results for England generally.

Mr. Dines also read a paper on the "Duration and lateral extent of Gusts of Wind, and the measurement of their Intensity."

The Royal Commission appointed to enquire into the Tay Bridge disaster, recommended that allowance should be made for an extreme wind presure of 56 pounds per square foot, but it is thought by some engineers, well qualified to form an opinion, that such high pressures do not occur in England, though much higher pressures have been recorded, and the question is: How much reliance can be placed on the instruments?

The paper gives an account of experiments and observations made to answer this, and opens with the statement that the attempt to obtain a record of the mean pressure and also the maximum pressure by the same instrument is hopeless. A pressure plate was so arranged as to act equally on two exactly similar springs, one spring being free and the other loaded with a two pound weight. The difference in the records given by the two springs, being a measure of the effect of the inertia (or momentum) of the weight. A sudden jerk, the force not being sustained even for an instant, caused the unloaded spring to give a higher value, but the force being sustained even for a second, caused the loaded spring to give the higher value. In a table the results of the loaded spring were expressed as percentages of the unloaded, the former giving the higher values in 27 cases out of 33, while its highest value is 171 per cent., and its lowest 73 per cent.

It appears from the table that the heavier a plate is, the more likely it will be to give too high a value.

It is very probable that jerking of the pen and pen carriage is the true explanation of the enormous pressures that have been recorded. Bidston Observatory is famous for high pressures, and, if the traces given in the Tay Bridge Report are exact copies, the scale at Bidston is the closest, and consequently, if the pencil is jerked an inch or so too high, it will have more effect on that record than on others with a more open scale.

The difficulty of measuring a rapidly-varying quantity is not confined to meteorology, but in other branches of science the instruments used for this purpose are designed so as to be adapted for the work they have to do. The indicator diagram of a steam engine, for example, would not be of much value if the diagram were drawn by an apparatus similar to the ordinary recording pressure plate; yet the variations of wind force seem to be almost as rapid as the variations of the steam pressure in the cylinder of an engine.

(To be continued.)

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1893.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	66·3	16	30·9	31	59·3	44·9	45·3	80	106·3	27·2	3·87	16	5·2
Malta	91·4	2	56·8	27	78·8	65·5	60·7	71	144·6	51·0	3·30	7	2·9
Cape of Good Hope	80·9	10	40·2	21	67·8	51·5	54·0	77	...	...	2·01	10	5·0
Mauritius	79·7	29	59·0	...	77·2	66·2	61·0	72	132·4	50·7	...	...	6·1
Calcutta	90·2	3	70·2	31	86·3	74·8	75·2	86	153·3	65·0	7·34	8	4·1
Bombay	90·1	31	71·4	20	87·2	74·9	72·6	76	139·7	60·8	·45	5	1·6
Ceylon, Colombo	88·0	28	72·3	8	85·5	74·8	69·7	72	155·0	67·0	5·59	20	4·2
Melbourne	84·8	8	41·8	11	67·1	50·8	49·3	75	134·8	35·3	3·42	12	6·1
Adelaide	100·0	26	41·5	21	72·4	51·3	48·0	60	153·6	34·6	1·29	12	5·1
Sydney	80·4	16	50·7	12	70·6	57·8	52·0	69	141·8	43·5	3·69	15	4·9
Wellington	71·8	16	45·0	1, 6	64·3	52·7	50·2	74	139·0	32·0	2·31	9	4·5
Auckland	71·0	10	46·0	1	65·5	54·1	55·5	87	137·0	42·0	1·07	10	6·1
Jamaica, Kingston	91·2	16	65·8	9	87·4	72·2	72·6	86	...	...	9·54	15	5·0
Trinidad	92·0	1	68·0	1	89·7	70·5	73·8	84	170·0	67·0	5·47	11	...
Toronto	68·4	9	26·9	31	56·6	40·6	43·6	79	...	21·2	3·61	10	5·1
New Brunswick, Fredericton	73·0	13	21·2	31	57·3	38·5	42·8	79	...	...	3·18	10	4·7
Manitoba, Winnipeg	61·0	6	12·0	28	48·0	28·1	...	...	...	...	1·35	8	6·5
British Columbia, Esquimalt	58·6	26	29·7	23	53·4	41·5	45·2	91	...	...	4·61	20	7·0

REMARKS.

MALTA.—Adopted mean temp. 70°·6; mean hourly velocity of wind 8·0 miles. Thunderstorms on 5 days and lightning on 4 other days. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·6 below, of dew point 0°·7 below, and rainfall ·71 in. below, their respective averages. Mean hourly velocity of wind 11·8 miles, or 0·4 mile above average; extremes, 26·4 on 12th and 17th and 1·7 on 4th; prevailing direction, E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 4th and 6th. Thunderstorms occurred on 5 days. D. G. MANTELL.

Melbourne.—Lightning on 6 days; thunder and lightning on 14th; Aurora on 10th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·1 below average. Absolute max. unusually high, only once exceeded (100°·5 in 1859) since the record began. Rainfall ·59 in. below average. C. TODD, F.R.S.

Sydney.—Temperature 0°·9 above, and rainfall ·74 in. above, the average. H. C. RUSSELL, F.R.S.

Wellington.—Fine weather up to the 12th, with pleasant variable winds. Very heavy rain on 12th; the remainder of the month generally showery, with intervals of fine weather. Prevailing winds N.W., strong during the middle of the month. Thunderstorm, with vivid lightning, on 21st. Mean temp. 4°·9 above, and rainfall 2·52 in. below, their averages. R. B. GORE.

Auckland.—An unusually fine and dry month, the total rainfall being less than one-third of the average. Barometrical pressure and mean temperature both considerably above the average. T. F. CHEESEMAN.

JAMAICA.—"Seasons" latter part of month—two inches over the average. Average velocity of wind 2·2 miles per hour. One great cyclone passed far N. of the Island *on 9th.* R. JOHNSTONE.

TRINIDAD.—*Rainfall* 1·20in. below the 30 years' average. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	1·92	XI.	Rhayader, Nantgwillt..	6·51
,,	Birchington, Thor	·74	,,	Lake Vyrnwy	6·60
,,	Hailsham	1·89	,,	Corwen, Rhug	1·10
,,	Ryde, Thornbrough	1·80	,,	Carnarvon, Cocksidia ...	2·49
,,	Emsworth, Redlands ...	1·57	,,	I. of Man, Douglas	2·61
,,	Alton, Ashdell.....	2·16	XII.	Stoneykirk, Ardwell Ho.	·44
III.	Oxford, Magdalen Col...	1·52	,,	New Galloway, Glenlee	3·95
,,	Banbury, Bloxham	1·45	,,	Melrose, Abbey Gate...	1·75
,,	Northampton, Sedgebrook	1·05	XIII.	N. Esk Res. [Penicuick]	3·70
,,	Alconbury	·66	,,	Edinburgh, Blacket Pl..	1·71
,,	Wisbech, Bank House..	·81	XIV.	Glasgow, Queen's Park.	3·37
IV.	Southend	·62	XV.	Inverary, Newtown	6·32
,,	Harlow, Sheering	·43	,,	Islay, Gruinart School..	2·09
,,	Colchester, Lexden.....	·65	XVI.	Dollar.....	2·69
,,	Rendlesham Hall	·85	,,	Balquhidder, Stronvar..	7·55
,,	Diss	1·02	,,	Ballinluig	2·18
,,	Swaffham	·93	,,	Dalnaspidal H.R.S. ...	6·21
V.	Salisbury, Alderbury...	1·59	XVII.	Keith H.R.S.	·71
,,	Bishop's Cannings	2·03	,,	Forres H.R.S.	1·23
,,	Blandford, Whatcombe.	2·11	XVIII.	Fearn, Lower Pitkerrie.	1·56
,,	Ashburton, Holne Vic....	4·22	,,	Loch Shiel, Glenaladale	9·46
,,	Okehampton, Oaklands.	3·59	,,	N. Uist. Loch Maddy ...	8·17
,,	Hartland Abbey	2·77	,,	Invergarry	8·33
,,	Lynmouth, Glenthorne.	4·42	,,	Aviemore H.R.S.	2·60
,,	Probus, Lamellyn	1·91	,,	Loch Ness, Drumnadrochit	4·34
,,	Wellington, Sunnyside..	2·24	XIX.	Invershin	2·54
,,	Wincanton, Stowell Rec.	1·74	,,	Scourie	3·79
VI.	Clifton, Pembroke Road	2·73	,,	Watten H.R.S.	1·33
,,	Ross, The Graig	1·34	XX.	Dunmanway, Coolkelure	4·28
,,	Wem, Clive Vicarage ...	1·29	,,	Fermoy, Gas Works ...	1·78
,,	Cheadle, The Heath Ho.	1·83	,,	Killarney, Woodlawn ...	3·80
,,	Worcester, Diglis Lock	·96	,,	Tipperary, Henry Street	2·14
,,	Coventry, Coundon	·98	,,	Limerick, Kilcornan ...	1·89
VII.	Ketton Hall [Stamford]	·68	,,	Ennis.....	...
,,	Grantham, Stainby	·50	,,	Miltown Malbay.....	2·60
,,	Horncastle, Bucknall ...	·55	XXI.	Gorey, Courtown House	1·31
,,	Worksop, Hodsck Priory	·54	,,	Athlone, Twyford	2·13
VIII.	Neston, Hinderton	1·49	,,	Mullingar, Belvedere...	2·26
,,	Lancaster, Rose Bank...	2·33	,,	Longford, Currygrane...	2·41
,,	Broughton-in-Furness..	2·94	XXII.	Galway, Queen's Coll...	3·99
IX.	Ripon, Mickley	2·17	,,	Crossmolina, Enniscoe..	4·08
,,	Scarborough, South Cliff	·96	,,	Collooney, Markree Obs.	2·90
,,	East Layton [Darlington]	1·39	,,	Ballinamore, Lawderdale	2·32
,,	Middleton, Mickleton..	2·78	XXIII.	Lough Sheelin, Arley ..	1·94
X.	Haltwhistle, Unthank..	2·27	,,	Warrenpoint	1·85
,,	Bamburgh.....	·39	,,	Seaforde	1·14
,,	Keswick, The Beeches...	4·76	,,	Belfast, Springfield	2·96
XI.	Llanfrechfa Grange	3·99	,,	Bushmills, Dundarave...	2·15
,,	Llandovery	4·61	,,	Stewartstown	1·98
,,	Castle Malgwyn	2·41	,,	Buncrana	2·34
,,	Builth, Abergwessin Vic.	8·29	,,	Lough Swilly, Carrablagh	2·83

METEOROLOGICA

ABBREVIATIONS.—Bar. for Barometer; Minimum; T for Thunder; L for Lig S for Snow.

STRATHFIELD TURGISS.—A f first half of the month, and very the end. Honey bee seen on 12 tortoiseshell butterfly flying on thorn in flower on 28th.

ADDINGTON.—The first half o heavy R on the 12th caused th extent for a short time. From veiled; the mornings were fre with occasional slight frosts at trees, which is in a very advan and 29th.

BURY ST. EDMUNDS.—A fin Several misty mornings in the saying, "So many mists in Ma this year. Fine aurora on the

NORWICH, BRUNDALL.—Ano March 17th to April 2nd abs March, 1893, and about 4° ab 1·78 in. deficient. Gales on 1s

LANGTON HERRING.—The continued until the 14th of M followed a period of bright, sunn drought lasted 20 days, from a. m. (43°·8) is 2°·4 above th storm. A solar halo was ob It was very dark from 29th.

TORQUAY, CARY GREEN.— an temp. 3°·2 above the a or 20 hours above the

POLAPIT TAMAR.—The first y wet; the last fortnight , and much colder at n k east winds. Heavy ga

STROUD, UPFIELD.—S.W. .

WOOLSTASTON.—A fine mo very dry. Mean temp.

TENBURY, ORLETON.—A fi p. 3° above the average days later than last year. end of the month. Chif display of aurora the sam

LEICESTER, BARKBY.—The stant night frosts, days es it will be more disastr

MANCHESTER.—The weath 13th; from 17th to 22n ificent spring weather. k fog till 10 a.m. on 27th

HULL, PEARSON PARK.— 26th, 28th, 29th and 3

HEATHWAITE.—8 on the 5th, 4·22 in.

METEOROLOGICAL NOTES ON MARCH, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A fine March, with frequent showers during the first half of the month, and very dry during the latter part, with frosts up to the end. Honey bee seen on 12th, thrushes' nest with 4 eggs on 16th. Nettle tortoiseshell butterfly flying on the 18th. Chiffchaff heard on 25th. Blackthorn in flower on 28th.

ADDINGTON.—The first half of the month was unsettled and showery, and a heavy R on the 12th caused the brook to overflow the meadows to a large extent for a short time. From the 15th until the end beautiful weather prevailed; the mornings were frequently foggy early, but afterwards very clear, with occasional slight frosts at night, not enough to injure the blossom on fruit trees, which is in a very advanced state. Fogs on 4th, 17th, 22nd, 23rd, 24th and 29th.

BURY ST. EDMUNDS.—A fine, dry, mild month, favourable for agriculture. Several misty mornings in the latter part of the month. Let us hope the old saying, "So many mists in March, so many frosts in May," will not come true this year. Fine aurora on the evening of the 30th.

NORWICH, BRUNDALL.—Another fine March, much resembling 1893. From March 17th to April 2nd absolutely rainless. Mean temp, 0°·5 lower than March, 1893, and about 4° above the average. R for the first three months 1·78 in. deficient. Gales on 1st, 11th and 13th; H and T on the 4th, at 4 p.m.

LANGTON HERRING.—The unsettled weather of the last week of February continued until the 14th of March, after which, to the end of the month, followed a period of bright, sunny days, many of them cloudless. The absolute drought lasted 20 days, from March 14th to April 3rd. The mean temp. at 9 a.m. (43°·8) is 2°·4 above the average of 23 years. On the 4th there was a H storm. A solar halo was observed on the 11th, followed by high wind on the 12th. It was very dark from 3 to 4 p.m. on the 20th. Fog on the morning of the 29th.

TORQUAY, CARY GREEN.—R during March 1·07 in. less than the average. Mean temp. 3°·2 above the average. Amount of sunshine at Chapel Hill, 182 hours, or 20 hours above the average.

POLAPIT TAMAR.—The first fortnight was more than ordinarily wet; in fact, very wet; the last fortnight was very dry, with an unusual amount of sunshine, and much colder at night. Remarkable absence during the month of bleak east winds. Heavy gale from S. on 12th; fogs on 16th and 17th.

STROUD, UPFIELD.—S.W. gales on 1st, 11th and 12th.

WOOLSTASTON.—A fine month, but the nights were very cold; the last half was very dry. Mean temp. 43°·8.

TENBURY, ORLETON.—A fine, dry month, with no R after the 15th, and mean temp. 3° above the average. Everything very forward; in fact, only about 4 days later than last year. Stone fruit and pears coming into blossom fast at the end of the month. Chiffchaff heard on 26th. Loud clap of T on 30th, and fine display of aurora the same evening. Fog on 3rd, 22nd and 29th.

LEICESTER, BARKBY.—The weather was very similar to that of last year: constant night frosts, days cloudless and hot, small rainfall; only if it continues it will be more disastrous, since it began with less R.

MANCHESTER.—The weather was cold and windy on the 2nd, 4th, 6th, 11th and 13th; from 17th to 22nd, bright and sunny; from 23rd to 26th and 28th, magnificent spring weather. Mean temp. 44°·5. Slight H shower on 13th; thick fog till 10 a.m. on 27th, and foggy morning on 29th.

HULL, PEARSON PARK.—Showers of sleet on 13th and 14th; fogs on 21st, 24th, 26th, 28th, 29th and 30th.

SEATHWAITE.—S on the 13th; T and L on 31st, about 1 p.m.; heavy R on the 5th, 4·22 in.

WALES.

HAVERFORDWEST.—The first fifteen days of March were stormy and wet, like the preceding months, but on 16th a sudden change of wind to the eastward took place, and the weather became fine, with sharp night frosts, the lowest grass reading being 21° on 17th. The days were fine and the sky cloudless, with bright warm sunshine. Vegetation unusually forward; sycamore in leaf on the 23rd; chesnut ready to burst into leaf on the 26th; blackthorn in full blossom on the 25th. The hedges quite green, cherry and pear trees blossoming; everything earlier even than last year.

GOGERDDAN.—Bright sunshine during the last fortnight, with N.E. wind.

SCOTLAND.

CARGEN.—The first fourteen days were very stormy, and a severe gale was experienced on the night of 11th–12th. The remainder of the month was rainless and very fine, with light airs, principally from the N. and E. The mean temp. of the month was 3° above the average. The sudden changes in the temp. during the last half of the month were very marked. On several occasions the daily range was 30°, and on the 27th as much as 34°. On the 27th the max. temp. reached 65°·6; on only two occasions during the last 34 years has this temp. been somewhat exceeded in March. The mean max. temp. of the last 10 days of the month was 62°·1, the mean min. 32°·3, a difference of almost 30°. Vegetation far advanced. Primroses and other spring flowers 10 days to a fortnight earlier than usual. L on the 9th. H on 11th, 12th, and 14th.

JEDBURGH.—The weather during the month was marked by low temperature during the night, and much clear sunshine during the day. The latter half was singularly dry, and the sowing of cereals was done with great ease and comfort. Old farmers remark that for many years there has not been such a fine seed time. The low night temperature checked the growth of grass.

BRAEMAR.—The old adage holds good for this month, "In like a lion and out like a lamb." Ground in fine order for sowing. Amount of sunshine recorded, 199 hours. L on 1st.

ROEBERRY.—The first half of the month was coarse and unsettled, the latter half very fine. Mean temp. 42°·4.

IRELAND.

DARRYNANE ABBEY.—Constant R during the first half of the month, but the second half very fine, dry, and warm, with S.E. wind. Aurora on 30th between 9 and 10 p.m.

WATERFORD, BROOK LODGE.—Some S on the Comeraghs on the 13th and 17th. E. or S.E. winds during the whole of the latter half of the month. H on the 11th. Thick fog at night on 20th; dense fog on morning of 30th.

O'BRIENSBRIDGE, ROSS.—From the 14th to the end perfect weather, with full sunshine on all but one day; slight fog on some mornings. The first two weeks were very wild and wintry. Aurora of very wide extent in north-west at night on 30th. Very little frost.

DUBLIN.—Until the 15th the weather was unsettled, stormy, and showery; after that date absolute drought occurred, lasting until the close of the month. Solar halos were seen on the 12th and 16th. S or sleet fell on 11th, 12th, and 15th; H on 5 days; more or less fog on 10 days.

CLIFDEN, KYLEMORE.—Stormy on 3rd, 7th, and 9th; strong gale from S on 10th. Sleet on 11th, 12th, and 13th. The second half of the month fine and almost rainless.

LONDONDERRY, CREGGAN RESERVOIR.—S on 11th, 13th, and 14th.

EDENFEL.—The first 15 days of the month were a continuance of the persistently wet and inclement weather that had prevailed since the opening of the year, the R for that short period considerably exceeding the average for the month. Thence to the end there followed 16 days of "absolute drought," with cloudless skies and warm sun by day and very light night frosts, enabling the *leeway in* farm work to be made up under the most favourable conditions. *Brilliant aurora on night of* 30th.

NOTICES.

It is requested that all Books for Review, and Communications
the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in
letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and
Meteorological Societies, and of the British Astronomical Association; Articl
by various eminent Astronomers, English, American, and Continenta
Correspondence on topics of interest connected with the Science; Notice
Observatories, Publications and current Discoveries. Notes on Meteors
Variable Stars, on Lunar Formations, etc., also are supplied for the assistan
and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable
publication.—*Prof. Young*, in "*Ten Years' progress in Astronomy.*"

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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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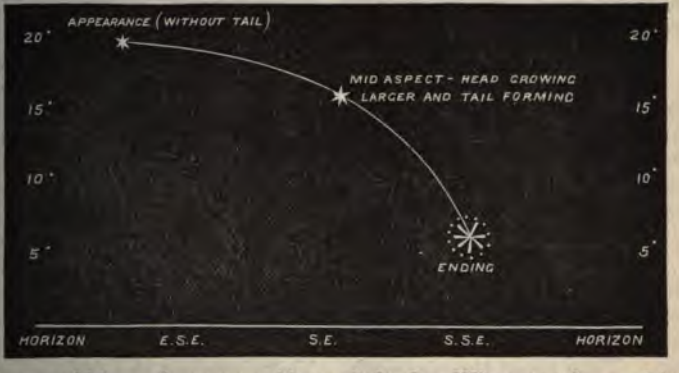
A SPLENDID FIREBALL.

To the Editor of the Meteorological Magazine.

SIR,—Whilst walking home last evening at 7.37 p.m., with my son and nephew, we observed a grand meteor, or fireball. It was almost light at the time, and the phenomenon appeared to last at least five seconds. It commenced with the aspect of a large planet about E.S.E., and some 20 degrees above the horizon. The head then plunged downwards, and vanished about five degrees from the horizon. The tail formed a splendid curve about 15 degrees in length, and the head increased in size during its flight, until it was vastly larger than Venus and Jupiter together, and in fact even rivalled the full moon. But after attaining its maximum it disappeared suddenly. Had it been dark, as it was an hour later, the



scene would have been magnificent indeed. What struck us chiefly about the fireball was its rapid development and apparent proximity. It seemed to stand out from the sky, and did not appear to be more than a few miles distant. I shall be curious to know if this grand display was equally favourably observed by others, and especially those who are most interested in the matter. Our position at the time was three-quarters of a mile west of Chiddingfold village, and on high ground.—Yours faithfully, A. F. PARBURY.

Chiddingfold, Surrey, 23rd April, 1894.

The following are other notes of the same meteor :—

LONDON.—On April 22nd, 7.35 p.m., during twilight, I observed a large meteorite, or fireball about 70° above the horizon, and travelling downwards towards the eastern horizon near to where the sun rises. It was in view for about five seconds, was pear-shaped and of a pale green colour, followed by a train of sparks. No stars were visible in the vicinity. If the sky had been dark and cloudless it would probably have been a conspicuous object in the heavens.—C. PHILLIPS, 125, Ossulton-street, Euston-road.—*English Mechanic.*

REDHILL, SURREY.—This evening, when my wife and I were out walking near Redhill, we saw a remakable meteor. Appearing near the meridian, it descended vertically towards the south-western horizon. At first of a brilliant white, it gradually changed to a pale green colour, and finally, when near the earth—apparently, it dispersed into several fragments, each of a bright red. The duration of the phenomenon was about four seconds, and the time 7.35 p.m. —D. W. B., April 22nd.—*Standard.*

GUILDFORD, SURREY.—A brilliant sight was observed here to-day. In bright daylight at 7.35, I saw a very large meteor fall in the east of the heavens in direct line to the earth, leaving behind a magnificent train of blue. After travelling to within apparently a very short distance of the earth, it broke into three pieces, something like the bursting of a sky-rocket, the lower portion being about the size of a breakfast cup. The sight was the more remarkable there being no other star visible in the clear light of the day.—ARTHUR ALLEN. —*Surrey Times.*

HASLEMERE, SURREY.—Yesterday evening, Sunday, April 22nd, a very fine meteor was seen to traverse the sky from near the zenith to near the horizon, in an easterly or south-easterly direction. It is reported to me as having appeared about 7.25 p.m., when twilight was strong, and before any stars had come out. It threw off sparks like a rocket, and was followed by a bright train. No noise was heard after the explosion.—ROLLO RUSSELL.—*Nature.*

RAMSGATE, KENT.—A very brilliant meteor was seen here about 7.20 p.m., April 22nd. It was of considerable size, much larger than Venus at her brightest, having the appearance of a very large rocket. Its colour was of a brilliant white at first, afterwards changing to blue and violet. It left a slight trail, which did not last. Time about three seconds. There was not the slightest noise. It appeared to come from the North-West.—DEIMOS.—*English Mechanic.*

WARMINSTER, WILTSHIRE.—I was fortunate enough to witness the splendid meteor of Sunday, about which your correspondents at Southampton and Guildford have written. I was driving back to Warminster from a neighbouring village church, when in full daylight, in a sky of the clearest blue, the meteor appeared, like an immense rocket. The direction seemed to be north-west to south-east, and the large star-shaped body, brilliant as the electric light,

slowly descended and disappeared without a sound. It must have been a powerful celestial phenomenon to be seen under the conditions prevailing. The time was 7.34 p.m.—J. F. WELSH, April 24th.

We have received letters from correspondents at Hampstead, Lee, Southend, Gravesend and Horsham, which describe the brilliant meteor on Sunday night. In all these places it was seen at the same time (7.35), and with the same effects.—*Daily News.*

[We have not yet seen any calculation of the path of this meteor, but apparently it was passing from N. to S., over the southern por tion of the North Sea, or perhaps over Belgium.—ED. *M.M.*]

ROYAL METEOROLOGICAL SOCIETY.

(*Continued from page* 43.)

The momentum of the plate itself, probably often adds 30 to 50 per cent. to the real pressure, and the sudden jerk transmitted through the chain or wire, often brings the pen or pencil another 50 per cent. above its proper place. Mr. Ellis has told us how substituting a flexible chain for a wire reduced the Greenwich pressure, and it is not unreasonable to suppose that if the chain also had been done away with, and the clock and drum placed close behind the plate, a still greater reduction might have been produced.

The pressure plate is a useful anemometer and gives very interesting results, including a perfectly accurate mean pressure. If it were provided with a rack and catch, so that it could not oscillate, and once driven back by the wind could not return until set by the observer, the record of the mean would be lost, but the record of the maximum would be reliable.

For obtaining information as to the duration of gusts the tube anemometer was used.

Two similar glass tubes were obtained and bent to exactly the same curve. They were partly filled with coloured paraffin oil and fixed on a frame side by side touching each other, with a velocity scale underneath. The ends of the tubes being connected with the head of the anemometer, the two columns of oil moved up and down together, registering exactly the same maximum velocity for each gust of wind. A piece of tube of $\frac{1}{32}$ in. bore and about 3 inches long was then inserted between one tube and the head, the other being left as before. The maximum velocities recorded for the same gust by these two tubes were given in a table.

The average difference is 4 miles per hour, the greatest 10 miles at a velocity of 43 miles per hour, and the least difference 0 mile, the higher velocity of course being recorded by the free tube.

It was found by experiment that the sudden application of a pressure corresponding to 40 miles per hour, the tubes then indicating zero velocity, produced the following effects:—

The liquid in the open tube rose to 43—44, owing chiefly to its momentum, but partly because some little of it remained sticking to

the glass, there not being time for it to settle to its true level. The liquid in the contracted tube rose steadily, it never exceeded the 40 miles per hour, but took from 5 to 6 seconds to reach that value.

We do not know how the gusts rise, so we cannot immitate them artificially, but during a gale in which the maximum velocity, as registered by the open tube, is about 60, the minimum will not as a rule fall below 20.

It appears that the extreme force of the wind is hardly ever maintained steadily for five seconds. If it were the two tubes would give maxima much nearer together. Also, since the contracted tube never falls so low as the other, it has not so far to rise, and would not take nearly five seconds to reach its maximum; hence it appears that a gust seldom maintains its full force for more than one or two seconds.

The same two glass indicating tubes were used to determine as far as possible the lateral extent of gusts. Neither of them was contracted, and they were connected with two separate but exactly similar anemometers, placed at the same height, viz. 18 ft. above the top of the house, but 11 ft. apart.

Even at so short a distance the extreme force is sometimes very different, and during a storm the liquid in one tube may be seen rising while that in the other is falling. One anemometer is S.E. of the other, and with a S.E. wind the two columns of liquid often move together as though rigidly connected. From this it appears that the extreme velocity mostly occurs in lines roughly parallel to the direction of the wind.

Mr. Airy, C.E., agreed that it is hopeless to get the maximum and mean by the same instrument, and that the Osler anemometer gives too high a maximum, though the mean may be correct, but to engineers the maximum is the more important value. A pressure plate kept face to the wind by a vane, when struck by a gust swings away and oscillates so that it never faces the wind.

At the Forth bridge in addition to an ordinary free pressure plate a second plate was fixed facing the direction of the frequent S.W. gales, and this gave a higher maximum than the free plate, owing to the oscillation referred to. A large plate 20 ft. by 15 ft. was also erected and gave results one third lower than the small plate. He considered that the duration of the extreme velocity in gusts was less than one second. In reply to Mr. Munro he said that the weight per square foot was much greater in the large plate than in the small one but he could not give the values.

Mr. R. H. Curtis remarked that the smaller pressure on a large plate was born out by experiments which he had made and communicated to the society some years since. He thought that the results as to the extension of squalls were affected by the inland position, and by the proximity of the house and of trees. The duration of squalls also was at times greater than that given in the paper as he had records of the extreme velocity lasting four seconds.

Mr. Dines, in reply, said that a plate which oscillates would never give the true maximum, but he had shown in a paper read before the Royal Society that the pressure on a plate might be greater when it was not at right angles to the wind. The experiments bore out his statement that gusts do not as a rule last one second, but that they did sometimes last as much as 4 seconds as mentioned by Mr. Curtis.

Mr. R. H. Scott, F.R.S., exhibited a diagram showing some remarkably sudden changes of the barometer in the Hebrides on February 23rd, 1894. At 8 a.m. the reading at Stornoway was 29·39 ins., being a fall of 0·73 in. since the previous day, and at 6 p.m. the reading was 28·58 ins. From the trace of the self-recording aneroid it appears that the minimum, 28·50 ins. occurred about 5.30 p.m., and that the fall during the half-hour preceding the minimum was nearly 0·20 in., the rise after the minimum being nearly as rapid.

The other paper read was "On the Calculation of Photographic Cloud Measurements," by Dr. K. G. Olsson.

AT the meeting of this Society held on Wednesday evening, April 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Inwards, F.R.A.S., the President, delivered an address on some phenomena of the upper air. He said that there are three principal ways in which the higher atmosphere may be studied. First, by living in it on some of the great mountain chains which pierce many miles into the air in various parts of the globe; second, by ascending into it by means of balloons; and third, by the study of the upper currents as shown to our sight by the movements of the clouds.

After describing the effects of rarefied air on animal life and natural phenomena, Mr. Inwards proceeded to give an account of various balloon ascents which had been undertaken with the object of making meteorological observations. In 1850 Messrs. Barral and Bixio, when they had ascended to 20,000 feet, found the temperature had sunk to 15° Fahr., but this was in a cloud, and on emerging from this, 3,000 feet higher, the temperature fell as low as —38°, or 70° below freezing point. In 1862 Mr. Glaisher and Mr. Coxwell made their famous ascent, when they reached an altitude of about seven miles from the earth. A short time ago a balloon without an æronaut, but having a set of self-recording instruments attached, was sent up in France, and from the records obtained it is shown that a height of about ten miles was attained and that the temperature fell to —104° Fahr. (136° below freezing point).

Clouds are simply a form of water made visible by the cooling of the air, which previously held the water in the form of invisible vapour. Cumulus clouds may be regarded as the tops of invisible warm columns or currents thrusting their way into a colder body of air.

After referring to the various classifications and nomenclatures of clouds, of which that proposed by Luke Howard in 1803 is still in general use. Mr. Inwards said that whatever system of naming and classifying clouds be adopted, it should depend on the heights of the various clouds in the air, and he gave a few rough rules by which the comparative altitudes of the clouds may be judged when there is no time or opportunity to make exact measurements. Among the indications by which a cloud's height may be gathered are its form and outline, its shade or shadow, its apparent size and movement, its perspective effect, and the length of time it remains directly illuminated after sunset. By the last method some clouds have been estimated to have been at least ten miles above the surface of the earth. The cloud velocities at high altitudes have been carefully noted at the Blue Hill Observatory, Mass., U.S.A., and show practically that at about five miles height the movement is three times as fast in the summer and six times in the winter as compared with the currents on the earth's surface.

After showing a number of lantern slides illustrating the various types and forms of clouds, the Aurora Borealis, and rainbow, Mr. Inwards concluded his address by urging the desirability of establishing a good cloud observatory somewhere in the British Isles.

At the close of the meeting the Fellows and their friends inspected the exhibition of instruments, photographs, and drawings relating to the representation and measurement of clouds, which had been arranged in the rooms of the Institution. A lantern display of slides showing cloud effects and other meteorological phenomena was also given.

The number of entries in the catalogue was 135, but as many of the entries included groups of objects, the total number of photographs and pieces of apparatus must have exceeded 500. We can, therefore, mention only a small proportion of the exhibits.

Among the apparatus were various patterns of cloud mirrors, nephoscopes, theodolites, and cameras, for ascertaining the direction in which clouds move, their velocity, and their altitude.

The photographs of clouds were indisputably finer and more numerous than had ever before been gathered under one roof, as will be readily proved by the following list of exhibitors :—

Acres, B.	Gaster, F.	Saunders, Col.
Angot, A.	Hall, A. D.	Singer, K.
Clayden, A. W.	Maclear, Adm.	Smart, F. G.
Cohen, L.	Manucci, Sig.	Sprung, A.
Davis, H. E.	Raymond, G.	Stroh, A.
Drewitt, F.	Riggenbach, A.	White, T. C.
Garnier, P.	Russell, H. C.	Wilson-Barker, Capt.

The exhibit which excited the greatest interest was a portrait of Luke Howard, taken about 1843, when the Father of English *Meteorology* was slightly over 70, and two original sketches of

clouds drawn by him, all lent by Mr. W. Dillworth Howard. There were copies of all the editions of Howard's "Essay on Clouds," including (very appropriately) Prof. Hellmann's reprint of the rare first edition, which was published only a few days before the exhibition; and there was a large (but not perfect) collection of engravings of clouds in various publications dating from 1722 to the present year.

The "Miscellaneous" and "New Instruments" exhibits included barometers, thermometers, anemometers, and sketches and photographs of Mr. Rotch's Pole Star recorder, of lightning, solar halos, hoar frost and auroræ, of damage by hail and by waterspouts.

On the whole, the Society is to be congratulated on an excellent exhibition, and on the good catalogue, which was ready on the opening day and distributed gratuitously to every visitor.

A BOLIDE OVER CENTRAL ENGLAND.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the correspondence on the above subject, which appeared in the *Met. Mag.*, vol. xxii., pp. 161, 177, it may interest your readers to know of a paper by Prof. Tomlinson, F.R.S., on "Aerolites and Bolides," and of discussion thereon, in *Notes and Queries*, October 22nd, November 26th, December 24th, 1892, pp. 321, 438, 512.—Yours truly,

FRED. COVENTRY.

The Holmes, Ketton, Stamford, April 21st, 1894.

[We wrote the head-line of the above letter as it now stands; the printer sent the proof headed "A BOLIS;" we reverted to Bolide, never having seen or heard of a Bolis. The printer referred us to the Dictionary, and there we are astonished to find:—

> "BOLIS. A fireball darting through the air, followed by a train of light or sparks."
> "BOLIDES. Plural of Bolis."

There is no doubt that the printer and the dictionary are right, because on turning to the origin, it is the Greek Βολὶς, *a missile weapon*, and in the plural Βολίδες, used occasionally to express *flashes of lightning*. Can any one quote even one passage containing the words "A Bolis?" We could quote many with a "A Bolide."—ED. *M.M.*]

RAINFALL IN NATAL.

IN recent numbers we have been able to give some information as to the rainfall of the colony of Natal; and we have just received a number of the *Natal Farmer*, which contains a rainfall table for January, 1894, so good, that we reprint it as an indication of the organization now existing in the Colony, and in the hope that we may obtain full particulars both for the past and the future. It is curious that the table bears no signature.

Weather Reports.—January.

	Rainfall in inches.	No. of days Rain fell.	Heaviest Rainfall in one day.		Temperature.	
				in.	Max.	Min.
Underberg	7·79	11	Jan. 5	... 2·01	° ...	° ...
Ladysmith	5·86	15		...	...	...
Dundee	7·38	12	,, 2, 3	...	91	60
Estcourt	7·81	14	,, 18	... 2·18	87	56
Little Tugela	...	...		...	...	...
Mooi River	8·08	12	,, 2	... 1·64	84	52
Gourton	9·98	13	,, 10	... 2·05	95	63
Karkloof	10·08	14	,, 31	... 1·70	90	56
Balgowan	7·11	16	,, 31	... 1·35	80	50
Howick (Everdon)	5·73	18	,, 2	... 1·46	88	52
Adamshurst	6·72	17	,, 3, 31	... 1·32	90	55
Hilton	5·78	15	,, 2	... 1·6	88	51
Newcastle	5·09	6	,, 21, 25	... 2·50	...	...
Botanic Gardens, Pietermaritzburg	8·87	12	,, 25	... 1·86	91	55
Town Bush Valley	8·70	16	,, 2	... 1·79	...	...
Boston	13·14	17	,, 2	... 8·02	83	42
Byrne	6·21	17	,, 21	... 1·38	98	50
Richmond Village	4·16	18	,, 24	... 1·42	90	51
Richmond	3·10	10	,, 2	... ·62	91	53
Umzinto	2·86	9	,, 25	... 1·96	95	61
Ifafa	...	...		...	...	...
Lower Umcomas	1·82	5	,, 24	... 1·23	...	...
Bellair	1·76	...		...	...	...
Malvern	2·34	12	,, 25	... ·90	...	...
Umbilo Water Works	2·45	9	,, 20	... ·55	92	64
Durban Observatory	1·72	11		...	...	...
Verulam, Redcliffe	3·75	7	,, 25	... 1·43	97	64
Verulam Village	1·64	7	,, 25	... ·67	97	61
Tongaat Mouth	2·39	7	,, 25	... ·75	92	66
Nonoti (Sea)	2·36	7	,, 24, 25	... 1·06	...	...
,, (Clifton)	...	...		...	...	...
Ottawa	1·41	7	,, 3	... ·39	...	...
Stanger	2·03	4	,, 25	... 1·27	106	58
Port Shepstone	3·17	9	,, 23	... 2·35	87	61
Ixopo	3·90	10	,, 24	... 1·12	88	52
Greytown	7·03	...	,, 19	... 1·07	86	56
Umzinto	3·21	9	,, 25	... 2·03	...	...
Clairmont	1·73	8	,, 27	... ·60	...	...
Equeefa	3·43	9	,, 24	... 2·26	...	...
Mount Edgecombe	1·80	8	,, 24	... ·45	91	63
Vaal River	2·51	9		...	...	...
Polela	12·68	17	,, 2	... 2·63	90	45

It will be noticed that Umzinto appears twice in the above table, as the 20th and as the 37th station. The differences and yet general accord induces the belief that there are two stations in the town, but if so, we do not understand why the entries are so far apart.

THE OAK AND THE ASH.

In the *Meteorological Magazine* for August and September, 1889, there were two long notes upon the old proverbs indicating the character of the season as shown by the priority of leafing of the oak and of the ash. The subject seems to have been again discussed in some of the daily newspapers, and the following note which we reprint from the *Journal of Horticulture*, may, perhaps, be accepted as a last word. The letter might have been more tersely expressed, but evidently the writer (like several of those in our previous numbers) lays great stress on the fact that inferences must not be based upon the leafage or non-leafage of single trees:—

OAK *v.* ASH SINCE THE BATTLE OF WATERLOO.—Mr. J. Roger Dutton, Reading, writes as follows in reference to the controversy regarding the Oak *v.* Ash which has been going on in the daily press:—"Now that the Oak and Ash are both out (although it will be fully ten days before an Ash attains that stage) we have the record of another spring to add to bygone years, and I think that I am in a position to answer the various points mooted during the past few weeks with reference to 'Oak and Ash.' I have before me a record as to both of these trees (applicable to several counties) for seventy-nine years—*i.e.*, since the Battle of Waterloo—the first fifty-six obtained from one who 'faithfully annotated' during the time, the last twenty-three carefully entered each year by myself. From this it appears that since the Battle of Waterloo the Ash has been out before the Oak only twelve times, and that 1859, or thirty-five years ago, was the last occasion. As I can confidently assert that the Oak has had priority ever since I kept a record, I am almost rash enough to question even the twelve years referred to, and for this reason. Some days ago I saw my first Ash in leaf. In the same hedgerow were two Oaks not yet out, and a casual observer of these would confidently assert that 'in 1894 the Ash was out before the Oak,' whereas the fact is that the Oak was out ten days previously, as on April 14th I wore in my hat a sprig with leaves fully expanded, taken by myself from a full grown Oak. This is the earliest year for the Oak, and the earliest but one for the Ash, in my record. We forget that there are early and late Oaks and Ashes, as there are early and late potatoes; and though it is possible occasionally, but very seldom, to find an early Ash out before a late Oak, I contend that in the same year there has been an early Oak out before the earliest Ash. If, however, in our forefathers' time it was not uncommon to see the Ash out before the Oak (and the old adage seems to assure us of this), may not the extensive drainage and culture of the last sixty years have had some effect in retarding the Ash or in advancing the Oak? As the Oak has undoubtedly been out first for at least thirty-five years, and we have had seasons of 'soak,' as well as of 'splash' only, I contend that the old adage is now valueless."—*Journal of Horticulture*, May 3rd, 1894.

REVIEWS.

Neudrucke von Schriften und Karten ueber Meteorologie und Erdmagnetismus herausgegeben von PROF. DR. HELLMANN.

No. 3. LUKE HOWARD.—*On the Modifications of Clouds.* London, 1803. Berlin [and London], A. Asher & Co., 1894, 4to., ix.—32 pages, three plates.

In our number for June, 1893, we reported under the heading, "New Issue of Old Meteorological Books," the publication of Nos. 1 and 2 of Dr. Hellmann's reprints. We have now the pleasure of announcing the receipt of No. 3, which in all respects maintains the excellencies of its precursors; in type, in plates, in paper, and in printing nothing could be better.

This leaves only two points open to consideration (1) the desirability of the reproduction, (2) the scientific and bibliographical value of the introductory notes.

Howard's system of cloud classification was first placed before the world in the *Philosophical Magazine* for July, September and October, 1803, and in a few copies of the three papers which Luke Howard had separately printed for private distribution. These separate copies form the first edition of his essay, "On the Modifications of Clouds," and are excessively scarce. We know of only two. Howard's system is the only one universally known to meteorologists, and even if a new classification ever be agreed to, we feel sure that Nimbus and Cumulus will survive, and will not improbably last as long as there are any clouds to be seen, or human beings to see them.

As regards Dr. Hellmann's notes, they are worthy of him, which is saying enough, for it proves that they are clear, to the point, and accurate. Those who can read German will find all attainable information respecting the work, and all who can read English can have for a few shillings that which pounds would not otherwise procure, a verbatim and facsimile reproduction of the first edition of Howard's clouds.

Elementary Meteorology, by WILLIAM MORRIS DAVIS, Professor of Physical Geography in Harvard College, Boston (U.S.A.) Ginn and Co, 1894; large 8vo., xii.—355 pages, 108 engravings and 6 charts.

IT is impossible to give in a limited space full notice of this important work. If asked to define by a single word its leading characteristic, we should say "solidity"; it bears on almost every page indication of its having been written with great care by a physicist and a teacher, and *per contra* there are several statements and omissions which lead us to think that Prof. Davis is not in the habit of personally making or reducing meteorological observations.

We are not sure of the appropriateness of the word "elementary"; of course it is merely a matter of opinion, and by calling it "elementary," it may be lifted beyond criticism, and all who cannot understand every sentence, must consider themselves unable to learn even the rudiments of meteorology. The book is intended for use in "the later years of a high-school course, or in the earlier years of college study," and we at once admit the soundness of the lessons it contains, but it seems to us written in a needlessly formal manner. Here for example are the opening sentences of

> "**197.** *Decreased rate of adiabatic change of temperature in cloudy air.*—We must return now to examine the effect of the liberation of latent heat in ascending currents of air when cloud-making has begun, and of the reverse process in descending cloudy currents.
>
> "The retardation of nocturnal cooling when latent heat is liberated in the formation of dew or frost has been explained in section 182. In that case the liberated energy passed away as terrestrial radiation into space, without doing any work on the earth. In the problem now before us, the liberated latent heat of an ascending, expanding current is applied to aiding in the work of pushing away the surrounding air; the heat of the ascending current is therefore drawn upon more slowly to do its share in this work, and hence the fall of temperature in the ascending air is retarded. This process is of wide application, and must be carefully considered."

It is characteristic of this work—strong in theory, weak as to instruments, that the above reference to terrestrial radiation induced us to search for the description of a "grass minimum" or of its precursor the "min. in focus of a parabolic reflector," and we can find neither. So again with solar radiation, we have the description of the "black bulb" in vacuo, but no reference to its companion "bright bulb" in vacuo.

We mention the point with reluctance, because we know that Professor Davis has the advancement of meteorology at heart, and because it is evident that both he and his publishers have taken great pains to produce a first-class text book—and we do not say that they have not succeeded—the work indisputably contains a vast amount of information given in clear and unmistakeable language. It has an accurate and copious index (probably more than 1,000 entries), and while we demur to its being an elementary book, we think that (except as to instruments) there is no one book in the English language which would be more useful for reference in case of any dispute as to the accepted causes and rationale of meteorological phenomena.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1893.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	59·8	3	27·8	1	47·9	36·0	37·5	85	83·0	24·4	2·17	15	7·3
Malta	80·0	1	53·0	26	71·5	61·0	56·1	74	127·2	48·1	3·37	9	6·5
Cape of Good Hope	89·2	25	45·2	1	74·1	55·9	58·2	82	...	...	·23	2	3·6
Mauritius	80·5	4, 30	63·2	11	78·7	66·9	61·2	70	137·6	52·8	1·78	17	5·6
Calcutta	84·0	1	58·7	30	80·5	65·6	65·4	79	143·4	50·6	·03	1	2·9
Bombay	90·8	2	69·9	23	86·9	74·3	71·0	74	139·3	62·3	1·63	5	2·3
Ceylon, Colombo	87·7	17	71·6	26	84·8	73·2	71·0	81	153·0	68·0	18·10	27	7·5
Melbourne	88·4	16	44·8	22	68·6	52·1	51·3	74	139·7	38·8	2·38	11	6·6
Adelaide	90·5	17	47·0	28	75·7	55·0	49·4	56	153·3	40·5	1·48	6	5·0
Sydney	86·8	4	53·6	29	73·9	60·6	58·5	70	151·8	43·6	4·05	21	5·8
Wellington	...	...	...	...	...	...	...	...	...	...	1·28	13	...
Auckland	81·0	24	51·0	18	72·0	58·4	57·0	80	146·0	49·0	7·17	17	5·2
Jamaica, Kingston	90·8	26	64·9	18	86·1	70·8	71·2	86	...	...	3·57	12	5·6
Trinidad	91·0	3, 4	67·0	23	88·0	69·5	72·6	82	169·0	65·0	7·84	15	...
Toronto	58·1	2	21·4	25	43·3	31·3	31·6	77	...	16·0	2·99	20	6·9
New Brunswick, Fredericton	62·7	3	9·2	27	41·1	23·1	27·8	77	...	...	1·86	10	5·2
Manitoba, Winnipeg	49·9	9	—30·3	29	23·9	5·5	...	...	...	...	2·34	12	7·2
British Columbia, Esquimalt	50·5	7	27·2	1	44·5	35·5	38·6	93	...	...	10·43	19	7·4

REMARKS.

MALTA.—Adopted mean temp. 64°·8; hourly velocity of wind 10·2 miles. Thunderstorms on 3 days; lightning on 8 days. J. F. DOBSON.

Mauritius.—Mean temp. of air 2°·2 below, dew point 2°·9 below, and rainfall 0·15 in. below, their respective averages. Mean hourly velocity of wind 10·6 miles, or 0·3 mile below average; extremes, 28·7 on 20th, and 0·0 on 3rd; prevailing direction, S.E. to E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 8 days, and lightning was seen on 3 other days. D. G. MANTELL.

Melbourne.—Lightning on 3 days; thunder and lightning on 12th; dust storm and smart squalls at 2.35 p.m. on 3rd. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5 below the average of 36 years. Rainfall ·47 in. above the average. C. TODD, F.R.S.

Sydney.—Temperature 0°·8 above, and rainfall ·80 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Auckland.—An exceptionally wet and warm month, the rain being accompanied by much thunder, but little wind. Total rainfall the greatest yet recorded for the month, and two and a-half times more than the average. Mean temperature 5° above the average. T. F. CHEESEMAN.

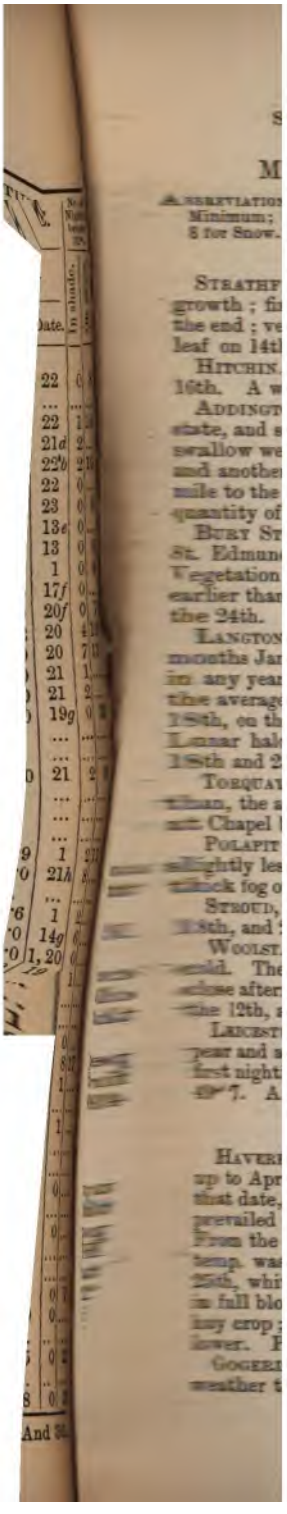
JAMAICA.—Rain in the first half of the month, with light thunderstorms; fair afterwards. Mean hourly velocity of wind 2·3 miles. The Kingston rainfall was half as much again as the average, while the Island rainfall was double the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·98 in. above the 30 years' average. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·76	XI.	Rhayader, Nantgwillt..	2·50
,,	Birchington, Thor	2·14	,,	Lake Vyrnwy	2·49
,,	Hailsham	2·41	,,	Corwen, Rhug	1·76
,,	Ryde, Thornbrough	2·07	,,	Carnarvon, Cocksidia ...	1·85
,,	Emsworth, Redlands ...	2·35	,,	I. of Man, Douglas	2·32
,,	Alton, Ashdell.....	2·21	XII.	Stoneykirk, Ardwell Ho.	1·98
III.	Oxford, Magdalen Col...	1·76	,,	New Galloway, Glenlee	2·72
,,	Banbury, Bloxham	1·83	,,	Melrose, Abbey Gate...	1·05
,,	Northampton, Sedgebrook	1·74	XIII.	N. Esk Res. [Penicuick]	1·70
,,	Alconbury	1·04	,,	Edinburgh, Blacket Pl..	1·75
,,	Wisbech, Bank House..	1·33	XIV.	Glasgow, Queen's Park.	1·91
IV.	Southend	1·91	XV.	Inverary, Newtown	1·94
,,	Harlow, Sheering	1·40	,,	Islay, Gruinart School..	·44
,,	Colchester, Lexden.....	1·64	XVI.	Dollar.....	·91
,,	Rendlesham Hall	2·28	,,	Balquhidder, Stronvar..	2·27
,,	Diss	2·15	,,	Ballinluig	1·77
,,	Swaffham	1·98	,,	Dalnaspidal H.R.S. ...	2·36
V.	Salisbury, Alderbury...	2·51	XVII.	Keith H.R.S.	1·03
,,	Bishop's Cannings	...	,,	Forres H.R.S.	·53
,,	Blandford, Whatcombe.	2·39	XVIII.	Fearn, Lower Pitkerrie.	·71
,,	Ashburton, Holne Vic....	4·40	,,	Loch Shiel, Glenaladale	...
,,	Okehampton, Oaklands.	2·79	,,	N. Uist. Loch Maddy ...	1·06
,,	Hartland Abbey	2·10	,,	Invergarry	1·18
,,	Lynmouth, Glenthorne.	1·79	,,	Aviemore H.R.S.	·78
,,	Probus, Lamellyn	4·13	,,	Loch Ness, Drumnadrochit	·41
,,	Wellington, Sunnyside..	2·50	XIX.	Invershin	·07
,,	Wincanton, Stowell Rec.	2·37	,,	Scourie	·70
VI.	Clifton, Pembroke Road	2·73	,,	Watten H.R.S.	·51
,,	Ross, The Graig	2·16	XX.	Dunmanway, Coolkelure	7·41
,,	Wem, Clive Vicarage ...	1·79	,,	Fermoy, Gas Works ...	5·86
,,	Cheadle, The Heath Ho.	1·64	,,	Killarney, Woodlawn ...	7·12
,,	Worcester, Diglis Lock	1·23	,,	Tipperary, Henry Street	6·36
,,	Coventry, Coundon	1·91	,,	Limerick, Kilcornan ...	2·98
VII.	Ketton Hall [Stamford]	1·21	,,	Ennis	3·67
,,	Grantham, Stainby	1·65	,,	Miltown Malbay.....	3·93
,,	Horncastle, Bucknall ...	2·08	XXI.	Gorey, Courtown House	3·75
,,	Worksop, Hodsck Priory	2·45	,,	Athlone, Twyford	4·49
VIII.	Neston, Hinderton	2·26	,,	Mullingar, Belvedere ...	4·29
,,	Lancaster, Rose Bank...	1·57	,,	Longford, Currygrane...	4·15
,,	Broughton-in-Furness..	1·41	XXII.	Galway, Queen's Coll...	3·76
IX.	Ripon, Mickley	3·17	,,	Crossmolina, Enniscoe..	3·84
,,	Scarborough, South Cliff	1·41	,,	Collooney, Markree Obs.	4·12
,,	East Layton [Darlington]	2·03	,,	Ballinamore, Lawderdale	5·45
,,	Middleton, Mickleton..	1·79	XXIII.	Lough Sheelin, Arley ..	4·05
X.	Haltwhistle, Unthank..	1·16	,,	Warrenpoint	3·06
,,	Bamburgh.....	1·00	,,	Seaforde	2·27
,,	Keswick, The Beeches...	2·39	,,	Belfast, Springfield	1·96
XI.	Llanfrechfa Grange	2·13	,,	Bushmills, Dundarave...	1·60
,,	Llandovery	2·12	,,	Stewartstown	2·76
,,	Castle Malgwyn	2·71	,,	Buncrana	2·36
,,	Builth, Abergwessin *Vic.*	2·54	,,	Lough Swilly, Carrablagh	2·48



METEOROLOGICAL NOTES ON APRIL, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A fine month for all vegetable and agricultural growth; fine at the commencement, showery and mild in the middle and at the end; vegetation very forward. Honey bee seen on 12th. Horse chestnut in leaf on 14th. Young rooks seen on 21st.

HITCHIN.—A very early season. Chestnut in bloom on 14th, hawthorn on 16th. A wasp's nest found on 30th.

ADDINGTON.—A fine open month; vegetation of all kinds in a very advanced state, and some hawthorn bushes well in flower in the last week. The cuckoo and swallow were with us on the 9th. A sharp TS occurred on the 11th at 2 p.m., and another on the 26th, on which day a very heavy H storm swept along, a mile to the N. of us, doing much damage to growing crops, and breaking a quantity of glass at Adstock, but no H fell here.

BURY ST. EDMUNDS.—R fell in small quantities on 16 days. Between Bury St. Edmunds and Cambridge much less R fell than in the surrounding districts. Vegetation very forward. Asparagus cut on the 4th. Foreign birds not much earlier than usual. Cuckoo on the 8th, nightingale on the 11th, swallow on the 24th.

LANGTON HERRING.—Rain has fallen on no less than 71 days in the four months January to April, 16 more than the average, and the greatest number in any year from 1879 to 1893. The mean temp. at 9 a.m. (50°·7) is 3°·5 above the average, but 1°·5 below that of April, 1893. Hawthorn in blossom on the 18th, on the same day of the month as in 1893. Grass crop very promising. Lunar halo on the 14th. Solar halos on 17th, 25th, and 26th. TSS on the 18th and 28th.

TORQUAY, CARY GREEN.—Rainfall ·42 in. less than, and rainy days one more than, the average. Mean temp. 4°·3 above the average. Amount of sunshine at Chapel Hill, 166 hours 30 mins., being 28 hours below the average.

POLAPIT TAMAR.—A very seasonable month altogether, the rainfall being slightly less than the average of 13 years. TS on 19th; distant T on 28th; thick fog on 20th.

STROUD, UPFIELD.—L on 2nd; T and L at night on 10th; TSS on the 11th, 18th, and 25th; on the latter day, very heavy H fell at Chalford, near Stroud.

WOOLSTASTON.—A pleasant and very growing month, though the nights were cold. There was a violent storm of T and L on the 11th, after an intensely close afternoon. T and L on the 2nd and 8th. The cuckoo was first heard on the 12th, and the swallow seen on the same day. Mean temp. 50°·4.

LEICESTER, BARKBY.—The country was lovely with the abundance of plum, pear and apple blossom. First cuckoo on the 10th; first swallow on the 11th; first nightingale on the 27th. T and L on 8 days; H on 2 days. Mean temp. 49°·7. A fine, but occasionally very cold, month.

WALES.

HAVERFORDWEST.—The drought, which set in on March 15th, was absolute up to April 6th; fine bright days, with sharp night frosts, continuing up to that date, the lowest grass reading being 26°·5 on 2nd. Broken weather then prevailed to the 18th, although many of the days were fine, R falling at night. From the 19th to the 23rd fine bright days with night frost occurred, and the temp. was cooler as the month advanced. Oak and ash both in leaf on the 25th, white thorn on the 28th; lilac in bloom in the 3rd week; rhododendrons in full bloom on the 25th. Grass abundant, with every indication of a good hay crop; everything as early as last year, but the max. temp. in shade 11°·1 lower. Prevailing winds, S.W. and N.N.W.

GOGERDDAN.—Beautiful growing weather throughout the month. Such good weather throughout April not remembered for more than 20 years.

SCOTLAND.

CARGEN.—A fine month generally speaking. The mean temp. was 2°·7 above the average, and there were unusually few frosty nights. The R was a little below the average. E. winds prevailed for 19 days. Vegetation progressed rapidly during the month, and is much more advanced than usual at this time of the year. Many trees are in full leaf, and hawthorn, lilacs, and laburnums are in flower; pasture lands unusually luxuriant. TS8 on the 2nd, 3rd, 24th, and 27th.

JEDBURGH.—For the period of the year the weather was unusually fine, and the cereal and potato crops were got in in fine condition. Vegetation generally was in an advanced stage, and the hedges had been in full bloom for ten days at the close. The bush and tree fruit crop had the appearance of being a very heavy crop, if not checked by bad weather.

COLMONELL.—The mean temp. of the month (49°·3) was 5°·1 above the average of 18 years, and the highest in any of them except 1893, which was 2° higher. The max. temp in 1886, 1892, and 1893 were all higher than this year, 71°, 75°, and 78° respectively. The min. temp. this year is the highest in April for 19 years. The average number of days with frost in April is 11, and till this year none has had less than three. T and L on 11th. Strong winds on 14th, 24th, 25th, and 26th, approaching to a gale only on 24th.

BRAEMAR.—Vegetation unusually forward. Sunshine 139 hours 40 minutes. T and L on the 25th, and T on 27th and 29th.

ROEBERRY.—A very dry month, the driest recorded since 1878. Mean temp. 45°·2.

IRELAND.

DARRYNANE ABBEY.—The first few days were fine and warm; the rest of the month was wet, cold, and stormy, with a few warm days. Very strong gale at night on 22nd and all day on 23rd. Heavy T from midnight to 2 a.m. on the 14th.

WATERFORD, BROOK LODGE.—T from 2 to 3 p.m. on the 4th. Heavy H on 24th. Cuckoo heard on 17th. Swallows seen on 25th.

O'BRIENSBRIDGE, ROSS.—Plenty of R. T on 2nd. Strong S.E. gale, with H showers and T, on 15th. Foliage of trees earlier even than last year. Beech, lime, sycamore, and horse-chestnut in full leaf on 19th. Oak also very forward, but leaf not so fully developed. Fine bloom on fruit trees.

CARLOW, BROWNE'S HILL.—More rain fell this April than has fallen in any corresponding month since 1877.

DUBLIN.—Like April, 1893, this was a mild month, and led to a forward spring. Unlike that month, however, the amount of cloud was large, particularly in the mornings, and R fell frequently and heavily. The prevalent winds were from S.E. and S. Under these several circumstances vegetation made rapid progress, and by the end of the month most of the forest trees were in full foliage, and the hawthorn, lilac, and laburnum were fast coming into blossom. The mean temp. was 49°·6, or 2°·2 above the average. Lunar halos on the 15th and 17th. Fog on 8 days. High winds on 5 days, reaching the force of a gale on 22nd and 24th. H fell on 13th and 24th. Aurora borealis on the evening of the 5th.

EDENFEL.—A moderate month, without any extremes; the R and temp., however, were both somewhat above the average, and unqualified by any appreciable frost. Vegetation of all kinds is early and luxuriant. The bursting into leaf of the oak simultaneously with the beech, instead of with the ash (which gives no sign), is very unusual. Swallows 10 days earlier than the average time; other migrants about the average.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXLI.] JUNE, 1894. [PRICE FOURPENCE, or 5s. per ann. post free.

THE MAY FROST OF 1894.

MAY frosts are usual, but the later they are, the more serious are their effects, and still more so if the spring has been mild and vegetation is forward. It is, we think to this, rather than to the intensity of the frost, that the great damage at the end of last month is due.

When travelling in the East Riding of Yorkshire we heard farmers talk of reploughing the fields, which a few days before had promised excellent crops of potatoes; shortly afterwards we received the box of ruined vegetation referred to on a subsequent page by Mr. C. L. Brook, and then the newspapers and especially the agricultural ones, began to describe the frost as unprecedented. We thereupon began to collect the facts, and although we are by no means sure of their meteorological importance, they are certainly of interest in connection with the agricultural disaster. We give (1) Typical letters from some of our regular correspondents; (2) reports as to damage extracted from the *Journal of Horticulture*. [Our readers must remember that many gardeners put their thermometers in positions by no means conformable to the rules of the Royal Meteorological Society, and that we reprint their figures without in any way adopting them]; (4) the lowest temperature in the air in the early morning of the three days May 20th, 21st, and 22nd; (5) the lowest on grass on the same days—(4) and (5) are chiefly from stations of unquestionable excellence, with proper stands and verified instruments—(6) a brief epitome.

To the Editor of the Meteorological Magazine.

SIR,—The frost of Sunday night, May 21st, or Monday morning (22nd), did great havoc to vegetation. Potatoes were blackened, yews, laurels and holly shoots "burnt off" by it, and an acacia tree was turned yellow and shed part of its foliage, as in October. Two-thirds of a magnificent prospect of roses were destroyed; the buds were in very forward and vigorous condition. The blossom (very luxuriant) of outdoor azaleas and rhododendrons blackened and utterly destroyed in that one terrible frost.

GEORGE BENTLEY.

Slough.

SIR,—Last May was the coldest May for at least 13 years, as the following table shows:—

MEAN TEMP. OF MONTH.
Thermometer in Stevenson Screen.

1882	51°4	1888	51°3
1883	51·9	1889	54·2
1884	54·1	1890	52·6
1885	48·0	1891	48·7
1886	51·1	1892	51·6
1887	49·0	1893	54·5

Mean of 12 years ..... 51·5
Mean of May, 1894..... 46·9

Deficiency on average of previous 12 years 4·6

The cold spell was more prolonged than I have ever registered, the minimum temperatures being:—

DATE. 1894.	Shade Temp. 4 ft. from Ground.	On Grass.	
	°	°	
May 20	30	28	Snowed a little.
,, 21	29	24	,, ,,
,, 22	30	26	
,, 23	32	24	
,, 24	35	28	
,, 25	30	24	
,, 28	34	27	Snow on Long Mountain in early morning.
,, 30	34	30	
,, 31	33	29	
June 1	33	29	

so that it froze on each night but three from the 20th May to June 1st. Potatoes terribly cut down. Ash leaves cut, and I fancy in many cases the budding leaves destroyed, as the trees look as though more than half their branches were dead. Sycamore leaves and fern fronds also suffered, while the gooseberries and currants are dropping off the trees, killed by the frost, which I fancy has also destroyed our apple crop, though some of Miss Ormerod's friends may have something to say to this last.

The rainfall for May was 3·55 in., with a maximum fall (on 15th) of 1·24 in., the heaviest rain since November 8th, 1890, when the same amount (1·24 in.) fell in the 24 hours.—Yours faithfully,

R. J. ROBERTS.

Pool Quay Vicarage, Welshpool, June 6th, 1894.

SIR,—Some details of the disastrous May frosts may be acceptable. The cool showery weather of May 1st—18th gave place on Saturday, May 19th, to a spell of severe cold, with strongish and

very piercing N.N.E. winds. On Sunday, May 20th, some hail fell, with rain in the afternoon, and when in the evening the sky cleared and the wind dropped, it was evident that mischief was impending. I covered up delicate plants with flower pots, matting both thick and thin, and newspapers, which last often give quite sufficient protection from a summer frost; put out a soup-plate full of water on the lawn, then set an alarum for 3.15 a.m., so that I was in my garden at 3.20 on Monday morning, just when the cold was at its worst. The air was wonderfully bright, keen, and still; the lawn as white as in any winter frost; hoar frost was on tops of gates close to my house; and the plate of water was solid ice. I saw the thermometer on the grass at 22°, and that in the shed at 25°. I tried watering some of the rows of potatoes, but the frost held till so long after sunrise that this could do no good. The frost had gone unchecked through the newspaper, and even through the matting so far that upper leaves were blackened; and a few days later, looking at a potato bed opposite my thermometer shed, I could not see where the rows had been!

The following night the minima were 26° in shed and 21½° on grass, and the cold continued, with much wind and frequent hail, and on 21st and 26th unmistakeable snow, heavy, wet snow, so that till the end of the month gardens had a bad time of it.

It is worthy of remark that my maxima for the last 13 days of May averaged 8°·6 lower than those of the first 12 days of April and for the whole of May 2°·3 lower than for the whole of April!

Not to speak of garden plants, the severity of the frost was shown by its blackening, to entire destruction, all the foliage of the ash in low-lying places to 20 ft. from the ground, and even some of the lower branches of oaks. Young shoots of ivy and of male fern were also cut off. Winter beans were in many cases unable to lift themselves again after the frost. The flourishing potato crop, so unusually forward, was cut back to the very ground, and the damage to fruit will only be known in the autumn.

As I do not read of the frost being worse elsewhere, I venture to trouble you with these minute details.

H. A. BOYS.

Easton Mauduit Vicarage, Northampton, June 4th, 1894.

P.S.—The cold seems to have had no effect on the wasps, which have been about in abnormal numbers till now, but may possibly be affected by to-day's heavy rain.

SIR,—I enclose a few specimens of the results of the recent frosts; the effects of it are simply disastrous, exceeding those of May 18th, 1891, owing to the fact that though the actual minimum has not been so low, the season of 1894 is some three weeks in advance of that year. Referring to the specimens, I cannot find a single strawberry blossom without a black centre; about three-fourths of the gooseberries are in the condition of the enclosed sample; a great

number of young beech leaves are shrivelled up, and at least half the oaks have *every leaf* in the condition of those I send, and hardly a single oak has entirely escaped; besides these every rhododendron flower that was open is absolutely destroyed, and every potato cut down to the ground; even common ferns have suffered to a large extent.

The readings were :—

	Stevenson Screen.	Old stand.	Grass.
1894.	°	°	°
May 21	26·3	26·2	22·0
,, 22	27·3	27·3	22·3
,, 23	30·7	30·8	25·9
,, 24	no frost	no frost	31·9
,, 25	28·7	28·8	24·5
1891.			
May 18	—	23·8*	19·8

Yours very truly, CHARLES L. BROOK.

Harewood Lodge, Meltham.

"As no report appears to have reached you from the Vale of Evesham, regarding the recent severe weather, a few remarks may be of interest to some of your readers in market gardening and fruit-growing districts. No previous spring frosts ever wrought such destruction as those of May the 20th and 21st. Runner beans and potatoes were cut down, marrows were killed under hand-lights, and almost everything in a growing state was more or less damaged. The worst blow was to the fruit. On all the flat land the plums and currants were killed, and the gooseberries, of which there was promise of an abundant crop, were quite three parts taken, but those under trees did not suffer so severely as those in the open. In a few very high parts of the district no damage was done. I noticed on the same piece of land the variety Keepsake are almost all killed, while Whinham's Industry is carrying a heavy crop, thus proving the hardiness of the latter variety. Strawberries are also seriously injured, some crops ruined. Early peas are crippled, and the main crop, Telegraph and Leicester Defiance, will be found very light at picking time. Apples and pears are not grown much in the market gardens, but I have noticed some dwarf trees of Lord Suffield, Lord Grosvenor, and Stirling Castle, and the apples appear stunted, so I am afraid that they will fall.

"I do not know whether the trees in other localities are damaged like they are here. The leaves (especially of the Pershore Plum) are all singed as if a fire had been lighted under them, and it also seems to have penetrated to the pith. Those branches carrying the most fruit appear to have suffered worst. Growers are at a loss to know what to do for the best with the trees." —MARKET GROWER.

As some of your readers may like to compare notes of the results of the frost on Sunday night, the 20th ult., and Monday morning, I send a few particulars. In south-east Somerset I find the temp. fell to from 22° to 25°,

* This is not from a Stevenson stand, but is from a verified thermometer in the old stand, and I find by comparison of the last six months between my old stand and the Stevenson that the difference is very small, probably not exceeding 2 or 3-tenths.

but it was accompanied with a cutting north-east wind. I have known several severe frosts in May and June during the last 30 years in this neighbourhood, but have not known one so disastrous, and attended with such serious results, as the one last week. The most mysterious thing is that these early and late severe frosts generally come on a Saturday or Sunday night.

The following is a summary of the result of the frost:—Walnut trees cut fearfully, also planes, oak and ash, from seedlings up to 12 and 15 feet. Beech (copper), and some other hardy trees are injured more or less. Of hardy shrubs, the following have the new growth entirely destroyed:—Abies Nordmanniana; yews, both English and golden; aucuba japonica; osmanthus; laurels, common, Caucasian, and rotundifolia, also the Portugal. Fruit appears very much injured, especially gooseberries. I fear apples and pears will also suffer very much. Of course potatoes, French beans and marrow, where above ground, are in many places quite destroyed.—B. R. D., *Yeovil.*

Since Monday, the 21st, we have had frosts more or less, varying from 2° to 8°, *i.e.*, down to 24°, with very cold winds and dull weather. Words almost fail to describe the havoc caused by the frost. Acres of potatoes are laid level with the ground, one farmer a short distance from here having lost a crop which he valued at £1,000. Shrubs which had been pruned in and have made two or three inches of growth, are quite blackened. In some places currants and gooseberries look as if they had been boiled, the ground underneath the trees being literally strewn with such fruit. All the early strawberry blooms are quite destroyed, as are also dwarf and runner beans. The oldest inhabitants in this neighbourhood say that they cannot remember a more destructive May frost.—R. P. R., *Liverpool.*

"With our thermometer hanging on the open espalier nearly 4 feet from the ground and about 100 yards from the river Wear, the frost on Monday, 21st ult., was 20°; 22nd, 20°; 23rd, 19½°; 24th, 25°; 25th, 21½°; thus making a mean of 21° for the consecutive five nights, and as even the grass is seriously damaged—in fact, I never saw anything like it—one may judge what are our fruit prospects hereabouts. The week previous was cold—bitterly cold—and what we may have left I think will be largely attributable to this cold, as all vegetation was thoroughly hardened, which perhaps reduced the damage to what might have been expected from a third less frost with softer conditions. I may say that I notice quite a scourge of green fly, and strange to say the insects do not seem to have been much affected.—Joseph Witherspoon, *Red Rose Vineries, Chester-le-Street, Durham.*

"Few persons perhaps remember so destructive and disastrous a May frost as that which occurred on the 21st of May in this year. Following upon a week of abnormally cold weather, we had a slight frost on Saturday night and Sunday morning, but it was left to the night of the latter day, and yesterday, to complete the work of destruction. A frost of any sort in May is always dangerous, and often destructive; but when it comes to 10° of frost—or 22° Fahrenheit—then, indeed, is the disaster complete, and the hopes of the year are absolutely and entirely destroyed.

"The morning of the 21st broke bright and sunny after the overnight frost, and disclosed a sorrowful sight. Ice a quarter of an inch in thickness was plentiful, and on the north side of walls and buildings the ground remained frost-bound far into the forenoon. In most gardens, and in many fields, potatoes were well above the ground; by noon there was nothing but the

blackened remains of the haulms above the ground level, so effectually are they killed. Seeding turnips, instead of being green, are turned to a sickly purple hue. According to Mr. W. Thompson, the thermometer at the Deanery Gardens registered 22° or 10° of frost."

The above cutting from the *Newcastle Daily Chronicle* will give you an idea of what the weather has been in the north. We registered 5° of frost here this morning, but our garden is sheltered.—W. A. JENKINS, *Aldine Grange Gardens, Durham.*

Minima in Shade in May, 1894.

COUNTY.	STATION.		DATE. 20th.	21st.	22nd.
			°	°	°
Surrey	Farnham (Great Down, Seale)		...	30·0	...
,,	Reigate (Woodhatch Lodge)		...	...	31·0
,,	Merstham	S	*	30·5	30·9
,,	Addington Hills	S	*	31·7	*
,,	Wallington	S	...	29·3	...
Kent	Keston Tower		...	27·0	...
Sussex	Ditchling	S	...	30·5	...
Hants	Strathfield Turgiss	S	*	29·4	29·9
Berks	Reading	S	*	31·0	*
,,	Yattendon		...	30·0	30·0
Herts	Broxbourne		28·0	...	...
,,	Berkhamstead (Rose Bank)	S	...	30·1	...
,,	Hitchen (Wratten)		...	29·0	29·0
Bucks	Winslow (Addington)	S	...	29·0	...
Oxford	Henley-on-Thames		...	29·0	...
,,	Oxford (Radcliffe Observatory)	S	*	31·0	*
,,	,, (St. Giles's)		...	30·0	...
Northampton	Easton Mauduit		...	25·0	26·0
,,	Castle Ashby		...	30·0	...
,,	Pitsford (Sedgbrook)		...	...	28·6
Cambridge	Cambridge Observatory	S	*	29·0	30·0
Essex	Chelmsford	S	*	29·2	*
,,	Harlow (Sheering)		...	30·0	...
,,	Halstead	S	*	29·4	31·8
,,	Saffron Walden (Newport)		24·0	...	...
Suffolk	Rendlesham Hall		...	27·0	...
,,	Haverhill (Great Thurlow)	S	*	28·3	30·5
,,	Bury St. Edmunds (Orchard St.)		28·0	...	...
,,	,, ,, (Westley)		...	31·0	...
Norfolk	Diss		29·0	...	...
,,	Hillington	S	*	31·9	31·9
Wilts	Salisbury (Alderbury)		30·0	30·0	...
,,	Marlborough (Mildenhall)	S	...	26·0	...
Dorset	Blandford (Whatcombe)		29·0	29·0	...
Devon	Buckfastleigh	S	*	31·0	31·5
,,	Brampford Speke	S	*	31·6	*
,,	Castle Hill	S	*	31·8	31·9
Gloucester	Cheltenham (Southam Villa)	S	*	29·2	*
Hereford	Burghill	S	*	31·8	*
Shropshire	Church Stretton (Woolstaston)		31·0	...	...
,,	Wem (Clive Vicarage)		30·0	...	...
Stafford	Burton (Hoar Cross)		25·0	...	...
,,	Cheadle (Heath House)	S	*	31·9	*
,,	,, (Tean Vicarage)	S	...	26·2	...
Warwick	Kenilworth	S	*	30·2	31·6
,,	Sutton Coldfield	S	*	30·1	*

Minima in Shade in May, 1894—(continued).

County.	Station.		Date. 20th.	21st.	22nd.
			°	°	°
Leicester	Barkby		...	24·0	...
,,	Loughboro' (Forest Road)	S	*	28·0	26·0
,,	Belvoir Castle		...	29·0	...
Rutland	Ketton Hall [Stamford]	S	*	31·0	31·0
Lincoln	Boston		...	30·0	30·0
,,	Horncastle (Bucknall)		...	29·0	...
,,	,, (Hemingby)		...	30·0	...
Notts	Hesley Hall [Tickhill]		...	27·0	...
Derby	Buxton	S	29·8	24·5	25·7
Lancashire	Manchester (Plymouth Grove)		30·0	30·0	...
,,	Bolton	S	*	30·4	*
,,	Hawkshead (Esthwaite Lodge)		...	...	28·2
York ..... *W.R.*	Meltham (Harewood Lodge)	S	...	26·3	27·3
,, ... ,,	Wakefield Prison		...	31·0	...
,, ... ,,	Halifax (Bermerside Observatory)	S	...	25·5	25·7
,, ... ,,	York	S	*	29·0	30·0
,, ... *E.R.*	Hull (Pearson Park)	S	...	29·0	...
,, ... ,,	Driffield (York Road)	S	*	28·6	31·8
,, ... *N.R.*	East Layton [Darlington]		...	28·0	...
Durham	Barnard Castle (Whorlton)		...	...	29·0
,,	Durham (Ushaw)	S	29·7	30·6	30·7
Northumberland	Haltwhistle		...	27·0	...
,,	Rothbury	S	30·0	28·0	26·0
Cumberland	Seathwaite	S	*	31·5	29·3
,,	Keswick	S	...	...	27·0
Westmoreland	Windermere	S	*	28·8	28·0
,,	Appleby	S	31·0	30·0	28·8
Monmouth	Monmouth (The Hendre)		...	30·0	...
,,	Llanvihangel Court		...	30·0	30·0
Carmarthen	Llandovery		...	27·0	...
Pembroke	Haverfordwest		...	...	29·4
,,	Castle Malgwyn [Llechryd]		...	24·0	...
Montgomery	Churchstoke (Mellington Hall)	S	30·1	29·0	30·4
,,	Welsh Pool (Pool Quay)	S	30·0	29·0	30·0

Minima on Grass. (*Below* 25°).

Hampshire	Strathfield Turgiss		...	24·9	...
Northampton	Easton Mauduit		...	22·0	21·5
Gloucester	Cheltenham		...	24·5	...
Stafford	Cheadle (Tean Vicarage)		...	19·0	...
Leicester	Loughboro' (Forest Road)		...	24·0	23·0
,,	Belvoir Castle		...	23·0	23·0
Rutland	Ketton Hall [Stamford]		...	...	23·0
Nottingham	Hodsock Priory		...	18·0	...
Lancashire	Southport (Hesketh Park)		...	24·3	...
,,	Bolton		...	21·2	22·0
York ..... *W.R.*	Meltham (Harewood Lodge)		...	22·0	22·3
,, ... *E.R.*	Driffield		...	22·0	...
Montgomery	Welshpool (Pool Quay)		..	24·0	...

S = Stevenson's Stand. * = Not below 32°. ... = No information.

We need not occupy much space with comment upon the foregoing, for incidentally nearly all the leading features have been touched upon:—

(1). It does not seem to us that the temperature can be described

as excessively low for May, but of course it makes a great difference whether a low reading occurs on the 1st or 31st, or as in this case on the 21st—23rd.

(2). No one has referred to the "Icy Saints" of May 11th to 13th, to the French proverb quoted by Mr. Inwards: "In the middle of May comes the tail of the winter," or to the well known fact of a cold period being usual in the middle or latter part of May.

(3). As usual, the frost was most severe in low lands, near streams, and none was recorded at any station on the English coast.

(4). Several remarks show that it was not the lowness of the temperature of the air which did the mischief, but the radiation of the heat into space, which was facilitated by a clear sky, and is proved by the grass temperatures.

(5). Judging from what we have heard, it seems by no means improbable that some large weed fires would have saved many an acre of potatoes by creating a smoke cloud adequate to lessen radiation.

(9). We wish that our readers would refer to the *Meteor. Mag.* for June 1891, and to the beautiful engraving of the snow storm of May 18th of that year, it will tend to show them that in rather minimizing the intensity of the recent frost, we had substantial ground for our argument; and if they will compare the minima in the general table for May 1891 with those on page 78 of this number, they will find that at the majority of English and Welsh stations, the frost of 1891 was more severe by about 1°.

(7). The facts in (1) and (2) being admitted, they have to be reconciled with widespread disaster—and nothing is more easy; a mild damp spring made vegetation forward and fuller of sap than usual, deficient sun had neither dried up the moisture nor hardened the vegetation, the plants were full of water, by the rapid cooling on a clear night the sap froze, the cells were broken by the expansion of the freezing sap, and the plant life was gone.

FIREBALL OF 1894—APRIL 22ND.

To the Editor of the Meteorological Magazine.

I have compared the interesting accounts of the brilliant fireball seen in the strong twilight of Sunday evening, April 22nd at 7.36. The descriptions though pretty numerous, are rather conflicting and in some instances too vague and incomplete to be serviceable in computing its real path in the atmosphere. There are several reports from Surrey, such as Haslemere, Kenley, Guildford, Redhill, &c., where the object appears to have descended in a vertical path towards the S.E. horizon, though the diagram in the *Meteorological Magazine* (May 1894) p. 49, represents the direction of flight to have been very different at Chiddingfold, Surrey. Any attempt to harmonize the various reports would be futile; the only course possible is to derive an approximate result that will satisfy in a general way, the majority of the observations. I have received one *good* determination of the end point from Mr. I. Evershed, of Ken-

ley, Surrey, who measured it as in azimuth 44° 30′ E. of S. and altitude 5° 45′. Mr. A. F. Parbury, at Chiddingfold, gives the altitude as 5° in S.S.E. Mr. R. W. Christy, of Chelmsford, describes the path as from near α Leonis (Regulus), to a little short of Corvus, while the Rev. F. T. Wardale, of Knebworth, Herts, says that the direction was from between α and β Leonis to between Orater and Corvus. At Bristol the meteor offered a fine spectacle, and was described to me as being a well defined ball of fire, of bluish colour, falling in the S.E. or E.S.E., and with a slight inclination from the vertical.

The meteor seems to have descended from a height of about 80 miles above the region of Hastings to a height of 17 miles over Amiens in France. It therefore passed above the Strait of Dover, and probably had a real path of more than 120 miles, traversed in about 4 seconds (average of 6 estimates) so that the velocity would be about 30 miles per second, but this is probably in excess of the actual speed. The direction of the meteor's flight was from N.W. to S.E., but the precise position of the radiant point cannot be given, though it is indicated in the neighbourhood of α Persei.

It is to be regretted that the results are open to question from the indefiniteness and contradictory character of the materials employed. This is, however, commonly the case in regard to casual observations of large fireballs. They are seen by all sorts of persons, few of whom are aware of the really necessary points to be noted, and of course the suddenness and unexpected nature of the spectacle is often so bewildering, that it becomes impossible for inexperienced eyes to retain a correct impression as to the most salient points. Even when scientific observers supply descriptions of this kind, it is not always they are found to be accordant and there is sometimes a pretty wide margin of error.

Large fireballs of similar type to that which appeared on April 22nd last, contain, apart from the attractions afforded by their striking aspect, some significant features likely to contribute to our knowledge of this branch of astronomy. But it is a most regrettable circumstance that they are nearly all allowed to escape that exact observation which alone can enable us to gain the instruction offered by their apparitions. It is to be hoped that future observers will recognise the utility of recording these bodies with greater precision. In all such cases the most important features are: the positions of the beginning and end point amongst the stars and the duration of flight. Other details, such as the brilliant effects of a meteor, its bursting, its train of sparks or phospheric streak, its coruscations, peculiarities of shape, &c., are of far less consequence, though deserving record after the position and duration have been carefully noted. When observers generally endeavour to supply accurate data concerning apparitions of fireballs not a year will pass but will add its quota of useful knowledge in regard to a very important and often beautiful class of phenomena.

W. F. DENNING.

Bristol, 1894, *May* 21*st*.

BOLIS, BOLIDE OR BOLID?

To the Editor of the Meteorological Magazine.

SIR,—On page 55 you have raised the question whether "Bolis" or "Bolide" is the correct form. May I suggest that neither is correct, and that we ought to use the term "Bolid"?

The rule is that in adopting words from the Greek which end in "ς" in the nominative and form the genitive in —αδος —ιδος or —οδος, the stem letter "δ" is made the terminal of the English form. It is enough to cite Æneid, Iliad, mænad, nomad, tetrad, tetrapod and Troad. In every case the vowel of the final syllable is short, while the addition of a final "e" would necessarily make it long.

Dr. Murray (*New English Dict.*, 1888) does not recognise "Bolis" at all. He gives "Bolide," citing as authorities Ross (1852), Proctor (1870) and Jefferies (1884). If the word cannot claim a longer prescription here, it is not, I hope, too late to adopt the more regular form. He marks the "i" long, which is no doubt the accepted, though inaccurate, pronunciation.

Webster, I observe, gives both "Bolis" and "Bolide," but cites no authority for the former, while he marks the quantity of the "i" as uncertain.

I agree that as against this rule we have "ephemeris" and "tripos," both naturalized in a less critical age—and for the latter we find "tripode" in Holland's Plutarch (1603). These do not seem to be sufficient authorities to induce us to depart from the rule.

May I now ask a little space to reply to Mr. Denning's letter on page 18 in answer to my communication on "Meteors" on page 8. I had not done so before, as I expected further discussion would have followed. I hope Mr. Coventry's letter is a proof that the subject is attracting attention.

The object of my remarks was not to formulate a theory—as I have said before, in the same connexion, it is much too early to do that—nor did I suggest a necessary coincidence of phenomena, but rather a possible connexion between different phenomena not coincident. That Mr. Denning has observed many meteors without *simultaneous* evidences of electrical action, is therefore not to the purpose. On the other hand, I have known many instances of electrical action clearly evidenced in the path of meteors within a few hours. These may very well be accidents. All I say is, let us observe and note. It is surely unscientific to shut the door to enquiry because it is not "promising," or to suggest that it is going back to theories of our forefathers. I should be obliged by a reference to any work where the co-relation of these phenomena has been proposed.

Mr. Denning has, in his last paragraph, quite misunderstood me. I did not suggest the slightest doubt of the accuracy of his computation. The point of my remark, which I hoped was sufficiently obvious, was to emphasize the statement in the beginning of my paper, that there was not one meteor, but that there were several.

Yours truly, JAMES G. WOOD, M.A.

115, Sutherland Avenue, W., June 4th, 1894.

To the Editor of the Meteorological Magazine.

SIR,—Referring to your inquiry on page 55 of the *Met. Mag.*, concerning the above, the following definition, accompanied by a quotation from Musschenbroek, appears in the Encyclopædic Dictionary (Cassell and Company, Limited) page 615, where it is classed amongst *obsolete* words :—

Bolis (pl. bolides). [Lat. *bolis*, from Gr. Βολὶς (*bolis*)—anything thrown, a missile, a javelin . . . a flash of lightning.]

Meteorology : A fire-ball dashing through the air, followed by a train of light.

"*Bolis* is a great fiery ball, swiftly hurried through the air, and generally drawing a tail after it. Aristotle calls it *capra*. There have often been immense balls of this kind." —*Musschenbroek.*

I am, yours faithfully,
GEORGE REDPATH.

16, *Primrose-street, Leith, June 1st*, 1894.

ROYAL METEOROLOGICAL SOCIETY.

The monthly meeting of this society was held on Wednesday evening, the 16th instant, at the Institution of Civil Engineers, Westminster; Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. W. Ellis, F.R.S., read a paper "On the relative frequency of different velocities of Wind," in which he discussed the anemometer records of the Greenwich Observatory for the five years 1888—1892, with the view of ascertaining the number of hours during which the wind blew with each of the different hourly velocities experienced during the period. The results of this discussion show that the wind blew for the greatest number of hours with the hourly velocities of 10 and 11 miles.

Mr. W. Marriott, F.R.Met.Soc., gave an account of a series of observations on the "Audibility of 'Big Ben" at West Norwood," which he had carried on for a period of five years. The Clock Tower at Westminster is 5½ miles distant from the point of observation, in a north-by-west direction. The large bell "Big Ben" was designed by Lord Grimthorpe, and cast in 1858; its weight is about 14 tons; it is 9 ft. 5½ in. in diameter, and 9⅜ in. in thickness; its tone being E. The observations were 976 in number, and were made at the hours of 9 a.m. and 9 p.m. The bell could be heard more frequently in the evening than in the morning, and on Sundays it was more frequently audible than on week-days. The direction of the wind most favourable for hearing "Big Ben," was between West and North. The observations were also discussed in relation to temperature, moisture, cloud and barometric pressure.

A paper by Mr. A. W. Moore was also read on "Earth Temperatures at Cronkbourne, Isle of Man, 1880—1889."

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1893.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	57·8	13	20·1	3	45·8	34·4	36·9	86	68·9	20·5	2·23	14	5·3
Malta	69·9	1	41·1	30	61·0	52·8	48·1	·76	126·2	37·5	7·37	22	7·1
Cape of Good Hope	91·6	12	48·5	6	77 2	59·0	56·4	66	...	...	·04	2	2·4
Mauritius	85·6	30	69·0	1*a*	83·2	71·4	66·7	73	138·5	62·2	1·40	16	5·4
Calcutta	78·0	27	51·5	13	75·9	55·8	57·0	76	135·5	43·8	·00	0	5·9
Bombay	87·6	1	67·9	22	85·0	70·7	64·8	66	135·7	50·0	·00	0	2·2
Ceylon, Colombo	89·2	...	70·8	...	86·9	72·0	69·3	75	148·0	60·0	6·13	8	3·0
Melbourne	99·8	10	43·8	3	74·7	54·7	52·9	68	147·5	37·2	2·55	9	5·7
Adelaide	107·8	10	47·4	19	84·1	58·8	50·0	46	165·3	43·2	·63	4	3·8
Sydney	93·6	6	54·2	4	76·6	62·8	58·5	66	148·1	44·9	1·47	...	5·0
Wellington	77·5	31	45·0	7	65·5	53·9	50·9	75	147·0	30·0	2·90	18	4·8
Auckland	76·0	23	52·0	16	70·7	57·7	56·6	76	146·0	50·0	4·65	17	5·5
Jamaica, Kingston	90·3	1	63·8	7	84·5	68·4	68·2	84	...	...	3·29	8	4·4
Trinidad	89·0	3, 4	65·0	23	86·7	69·0	70·0	79	168·0	65·0	7·23	23	...
Toronto	51·5	25	— 4·6	13	22·1	15·1	23·2	84	...	-- 9·0	4·60	24	7·4
New Brunswick, Fredericton	39·9	1	—26·0	15	24·0	2·7	13·3	84	...	...	6·09	20	6·2
Manitoba, Winnipeg	34·0	22	—39·1	10	5·6	—18·6	...	...	...	...	·62	12	4·6
British Columbia, Esquimalt	52·6	3, 15	29·2	27	46·4	38·5	41·6	95	...	...	9·75	28	8·6

a And 12, 22.

REMARKS.

MALTA.—Adopted mean temp. 56°·3; mean hourly velocity of wind 9·3 miles. Thunderstorms on 6 days, and lightning on 6 other days; hail on 3 days. Rainfall double the average. The month was unusually cloudy, with less than the average amount of wind. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·5 below, of dew point 1°·2 below, and rainfall 3·67 in. below, their respective averages. Mean hourly velocity of wind 8·8 miles, or 2·0 below average; extremes, 21·4 on 14th, and 0·0 on 27th and 30th; prevailing direction, E.S.E. to E. by N. Thunder on 22nd, and lightning on 24th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 1st and 24th; thunderstorms occurred on 6 days. D. G. MANTELL.

Melbourne.—Hail on the 15th; lightning on the 5th and 11th; thunderstorms on the 25th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·4 above the average of 36 years. Rainfall ·21 in. below the average. C. TODD, F.R.S.

Sydney.—Temperature the same as the average of 35 years; humidity 3°·8 less than the average; rainfall 1·14 in. less than the average. H. C. RUSSELL, F.R.S.

Wellington.—Rather showery weather during the month, though the total rainfall was 1°·04 in. below the average. Prevailing winds S.E. and N.W., generally moderate. Mean temp. 1°·1 below average. Slight earthquake on 9th. R. B. GORE.

Auckland.—A warm, moist month, the rainfall being nearly twice the average; otherwise there were no exceptional features to record. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 2·4 miles; prevailing direction S.S.E.; greatest number of miles per day, 119; least, 21. Rainfall considerably above the average both in Kingston and the Island generally. R. JOHNSTONE.

TRINIDAD.—Rainfall 2·42 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·21	XI.	Rhayader, Nantgwillt..	4·73
,,	Birchington, Thor	3·17	,,	Lake Vyrnwy	3·86
,,	Hailsham	1·61	,,	Corwen, Rhug	...
,,	Ryde, Thornbrough	1·18	,,	Carnarvon, Cocksidia ...	3·55
,,	Emsworth, Redlands ...	1·05	,,	I. of Man, Douglas	4·19
,,	Alton, Ashdell.....	2·21	XII.	Stoneykirk, Ardwell Ho.	2·90
III.	Oxford, Magdalen Col...	1·35	,,	New Galloway, Glenlee	3·26
,,	Banbury, Bloxham	1·48	,,	Melrose, Abbey Gate ...	4·63
,,	Northampton, Sedgebrook	1·40	XIII.	N. Esk Res. [Penicuick]	4·35
,,	Alconbury	1·27	,,	Edinburgh, Blacket Pl..	3·20
,,	Wisbech, Bank House..	1·66	XIV.	Glasgow, Queen's Park.	2·28
IV.	Southend	1·53	XV.	Inverary, Newtown	3·65
,,	Harlow, Sheering	1·74	,,	Islay, Gruinart School..	·84
,,	Colchester, Lexden.....	1·74	XVI.	Dollar.....	2·37
,,	Rendlesham Hall	2·11	,,	Balquhidder, Stronvar..	3·08
,,	Diss	2·86	,,	Ballinluig	2·07
,,	Swaffham	2·41	,,	Dalnaspidal H.R.S. ...	3·81
V.	Salisbury, Alderbury...	1·67	XVII.	Keith H.R.S.	6·63
,,	Bishop's Cannings	1·60	,,	Forres H.R.S.	3·22
,,	Blandford, Whatcombe.	2·82	XVIII.	Fearn, Lower Pitkerrie.	3·52
,,	Ashburton, Holne Vic....	2·96	,,	Loch Shiel, Glenaladale	6·33
,,	Okehampton, Oaklands.	3·85	,,	N. Uist. Loch Maddy ...	2·44
,,	Hartland Abbey	3·03	,,	Invergarry	2·54
,,	Lynmouth, Glenthorne.	2·29	,,	Aviemore H.R.S.	3·03
,,	Probus, Lamellyn	2·46	,,	Loch Ness, Drumnadrochit	3·65
,,	Wellington, Sunnyside..	2·04	XIX.	Invershin	2·11
,,	Wincanton, Stowell Rec.	2·13	,,	Scourie	3·95
VI.	Clifton, Pembroke Road	1·94	,,	Watten H.R.S.	4·16
,,	Ross, The Graig	2·96	XX.	Dunmanway, Coolkelure	2·66
,,	Wem, Clive Vicarage ...	2·66	,,	Fermoy, Gas Works ...	1·36
,,	Cheadle, The Heath Ho.	2·89	,,	Killarney, Woodlawn ...	2·77
,,	Worcester, Diglis Lock	2·89	,,	Tipperary, Henry Street	2·31
,,	Coventry, Coundon	2·31	,,	Limerick, Kilcornan	2·06
VII.	Ketton Hall [Stamford]	1·27	,,	Ennis	3·90
,,	Grantham, Stainby	1·69	,,	Miltown Malbay.....	3·80
,,	Horncastle, Bucknall ...	1·32	XXI.	Gorey, Courtown House	3·05
,,	Worksop, Hodsck Priory	1·34	,,	Athlone, Twyford	3·51
VIII.	Neston, Hinderton	1·99	,,	Mullingar, Belvedere ...	3·35
,,	Lancaster, Rose Bank...	2·85	,,	Longford, Currygrane...	2·78
,,	Broughton-in-Furness..	3·94	XXII.	Galway, Queen's Coll...	3·90
IX.	Ripon, Mickley	1·87	,,	Crossmolina, Enniscoe..	4·46
,,	Scarborough, South Cliff	1·73	,,	Collooney, Markree Obs.	2·81
,,	East Layton [Darlington]	2·39	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	2·24	XXIII.	Lough Sheelin, Arley ..	2·46
X.	Haltwhistle, Unthank..	3·29	,,	Warrenpoint	2·76
,,	Bamburgh.....	2·04	,,	Seaforde	2·91
,,	Keswick, The Beeches...	4·73	,,	Belfast, Springfield	3·30
XI.	Llanfrechfa Grange	2·71	,,	Bushmills, Dundarave...	2·05
,,	Llandovery	3·26	,,	Stewartstown	2·45
,,	Castle Malgwyn	3·67	,,	Buncrana	2·95
,,	Builth, Abergwessin Vic.	4·81	,,	Lough Swilly, Carrablagh	2·37

MAY, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	1·85	— ·05	·41	10	16	71·5	15	33·0	21
II.		Maidstone (Hunton Court)...	1·71	+ ·33	·44	26	14	...	...	...	...
,,		Strathfield Turgiss	1·66	— ·21	·25	29	17	68·2	25	29·4	21
III.		Hitchin	2·09	+ ·14	·65	31	15	66·0	15*a*	29·0	20
,,		Winslow (Addington)	1·55	— ·55	·50	11	16	64·0	15*b*	29·0	21
IV.		Bury St. Edmunds (Westley)	2·68	+ ·93	·90	26	15	72·0	16	31·0	21
,,		Norwich (Brundall)	2·73	...	·72	26	22	70·0	16	34·0	21
V.		Weymouth(LangtonHerring)	1·45	— ·16	·27	16	15	66·0	18	35·0	21
,,		Torquay (Cary Green)	2·43	...	·64	17	15	66·6	25	35·5	21
,,		Polapit Tamar [Launceston]..	2·69	+ ·86	·56	8	19	67·0	18	37·0	22
VI.		Stroud (Upfield)	2·01	— ·03	·56	15	20	67·0	24	36·0	20
,,		ChurchStretton(Woolstaston)	3·68	+ ·81	·73	11	21	61·5	25	31·0	20
,,		Tenbury (Orleton)	3·13	+ ·58	·52	11	19	69·0	25	30·0	28
VII.		Leicester (Barkby)	1·99	+ ·02	·61	30	18	69·0	25	24·0	21
,,		Boston	2·15	+ ·43	·35	31	17	72·0	25	30·0	21
,,		Hesley Hall [Tickhill].....	1·09	— ·95	·26	9	17	64·0	13	27·0	21
VIII.		Manchester(PlymouthGrove)	2·61	+ ·26	·52	30	19	67·0	24*a*	30·0	20
IX.		Wetherby (Ribston Hall) ...	1·88	— ·07	·42	10	14	...	...	...	...
,,		Skipton (Arncliffe)	2·91	— ·81	·47	13	20	...	...	...	...
,,		Hull (PearsonPark)	1·99	+ ·11	·34	25	18	63·0	14	29·0	21
X.		Newcastle (Town Moor)	2·36	+ ·61	·43	2	21	...	...	...	...
,,		Borrowdale (Seathwaite).....	8·17	— ·44	1·73	13	21	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·45	— ·40	·50	15	15	...	...	...	...
,,		Haverfordwest	4·23	+ 1·87	1·20	15	18	71·2	19	29·4	22
,,		Aberystwith, Gogerddan	4·37	...	·91	8	14	72·0	18	22·0	20
,,		Llandudno.....	2·42	+ ·49	·60	14	19	60·4	15	34·2	22
XII.	SCOTLAND.	Cargen [Dumfries]	4·29	+ 1·77	1·14	14	21	65·4	24	29·0	21
,,		Jedburgh (Sunnyside).....	3·10	+ 1·20	·76	14	19	65·0	24	27·0	22
XIV.		Colmonell	2·61	...	·47	13	14	71·0	18	27·0	21
XV.		Lochgilphead (Kilmory)	3·48	+ ·13	·56	7	18	...	...	26·0	19
,,		Mull (Quinish)	4·20	+ 1·25	1·11	8	18	...	...	...	...
XVI.		Loch Leven Sluices	2·50	— ·06	·50	15	13	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·20	+ 1·54	1·00	14	21	65·8	25	29·5	20
XVII.		Braemar	3·90	+ 1·49	·59	25	25	62·0	24	24·2	22
,,		Aberdeen (Cranford)	4·03	...	·73	27	22	59·0	11	31·0	21
XVIII		Strathconan [Beauly]	4·74	+ 1·65	·95	16	14	...	...	...	...
,,		Glencarron Lodge.....	6·20	...	·74	6	24	61·7	23	28·5	21
,,		Cawdor [Nairn]	4·20	+ 2·45	1·07	15	22	...	...	...	...
XIX.		Dunrobin	3·55	+ 1·45	·73	28	18	63·0	24	32·0	13
,,		S. Ronaldsay (Roeberry).....	2·22	+ ·50	·34	14	18	59·0	24	30·0	19
XX.	IRELAND.	Darrynane Abbey.....	3·02	...	·56	12	22	...	...	...	...
,,		Waterford (Brook Lodge) ...	1·98	— ·25	·45	29	14	68·5	25	33·0	21
,,		O'Briensbridge (Ross)	3·16	...	·58	15	12	...	...	...	...
XXI.		Carlow (Browne's Hill)	4·65	+ 2·31	·76	30	20	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·56	+ 1·63	1·33	15	17	64·5	25	33·0	21
XXII.		Ballinasloe	3·21	+ ·52	·42	13	18	62·0	25	32·0	21
,,		Clifden (Kylemore)	6·05	...	·99	7	19	...	...	...	...
XXIII		Waringstown	2·08	— ·36	·67	30	14	69·0	31	28·0	21
,,		Londonderry (Creggan Res.).	2·91	+ ·39	·61	8	21	...	...	...	...
,,		Omagh (Edenfel)	2·94	+ ·47	·49	13	20	68·0	24	29·0	21

a And 25. *b* And 24. *c* And 21. *d* And 22.

+Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON MAY, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month of May retained its fickle character, with a temp. rather below the average. The severe paroxysm of cold on the 21st and 22nd was most disastrous to vegetation, cutting down everything to the ground, and killing all the young shoots of ash and laurel; the potatoes also suffered greatly. T on 15th, 28th and 29th; L and T on 30th.

ADDINGTON.—A rather cold month, with a moderate R. Up to the 20th there was the prospect of abundant crops of fruit of all kinds, but a sharp frost on the morning of the 21st changed the appearance of things. Currants and gooseberries (the latter quite large) were much injured. All the first blossom on strawberries was destroyed, and young shoots on many trees were cut quite back. Plums, pears and apricots escaped. Distant T on the last three days of the month.

BURY ST. EDMUNDS.—The month was chiefly remarkable for the sharp frosts of 21st and 22nd; the exposed thermometer here fell to 28°, but it was much colder in the valleys. Vegetation was greatly damaged; potatoes, beans and ash trees quite black; barley turning yellow from the frost and cold. Vegetation much retarded, and at the close about as forward as usual. T on 10th, 26th, 28th, 29th, 30th and 31st; H and S on 26th.

LANGTON HERRING.—A cold month, and the weather very unsettled. Mean temp. at 9 a.m. (51°·6) 2°·4 below the average, the mean min. and mean max. being very nearly the same as those of the preceding month. From the 19th to the 23rd inclusive it was very cold, frost slightly damaging vegetation, and the weather being quite wintry. Solar halo on the 25th; T on the 26th.

TORQUAY, CARY GREEN.—Rainfall ·14 in. greater than, and rainy days exactly, the average. Mean temp. 0°·9 below the average. Amount of sunshine, 203 hours 50 mins., being 3 hours 30 mins. below the average.

STROUD, UPFIELD.—Frost on the 20th—potatoe tops touched, fruit destroyed, and much damage done in the valleys. T heard, and H storm in afternoon, on 29th.

WOOLSTASTON.—The earlier part of the month was genial and growing, but on the 20th it became very cold, with sharp frosts on the grass, doing great injury to the crops and the early vegetation. Violent H, with T, on the 26th, and again on the 28th, 29th and 30th. Mean temp. 47°·4.

TENBURY, ORLETON.—A very cold, unseasonable month, with a mean temp. 3° below the average, though not so cold as in 1885 and 1887. Severe frosts at the end of the month—particularly on 20th, 21st and 28th—did much damage to potatoes, fruit, &c. T on 26th, 28th, 29th, 30th and 31st.; H on 26th and 28th, and L on 26th.

LEICESTER, BARKBY.—A cold month, with heavy T during the last week. Mean temp. (49·5) lower than that of April. The frosts of 21st and 22nd were very destructive, ·02 in. of R. which had fallen just before, being turned into a coating of ice.

BOSTON.—Sharp frosts on the 21st and 22nd, which did a great deal of harm to the early potatoes, strawberries and fruit trees.

MANCHESTER, PLYMOUTH GROVE.—The coldest May experienced since observation commenced 27 years ago, with the one exception of May, 1885, when the mean temp. was 49°·0. The temp. on grass fell to 25° on the 20th and 21st, and to 28° on the 24th, and considerable damage was done to fruit and vegetation. T and L on the 29th; T S and H shower on the 30th. Mean temp. 49°·1.

WALES.

HAVERFORDWEST.—May commenced fine, but with a much reduced temperature from the preceding month. The wind blew with great force on the night

of the 3rd and on the 4th. It was generally dry, cool and fine up till the 9th, when an exceedingly wet period set in, and between that date and the 15th more R fell than in the months of April, May and June, 1893. This stimulated vegetation amazingly in conjunction with fine sunlight and warm temp., but a severe check set in on the 20th, after a day of unusual warmth, and N.E. winds, with clear sky, and low night temperatures prevailed to the 27th. The last four days were wet.

GOGERDDAN.—Very cold throughout the month, with S and H storms and sharp frosts, doing much damage to all vegetation.

SCOTLAND.

CARGEN.—The mean temp. of the month (46°·9) is 3°·9 below the average for May. Rather severe frosts occurred on the 21st, 22nd, 23rd, and 24th, and great damage was done to vegetation. All early potatoes were frosted down, and much damage done to grass lands, young shoots of trees, flowering shrubs, &c. With the exception of 1885, when the mean temp. was 46°, this is the coldest May since observations commenced 34 years since. The total R for the first five months of the year is 8·07 in. above the average. N. and E. winds prevailed for 23 days. TSS occurred on 17th, 21st, 29th, 30th, and 31st. S and H fell on the 20th, 21st, and 27th. In every respect it was the worst May for many years. Slight earthquake shock on 16th. Very brilliant meteor at 8.15 p.m. on 18th, travelling from N.W. to S.; it separated into two parts, leaving a long train of light distinctly seen, though it was bright daylight.

JEDBURGH.—The weather was most ungenial. The wind after the 8th, with one exception, was either N., N.E., S.E., or E. The frost that began on the 20th injured potatoes, bush and tree fruit, and beech, sycamore, spruce, and pine shoots. Vegetation made little progress during the month.

MULL, QUINISH.—Frost on night of 19th blackened potatoes and young growth of trees, &c. T, L, and H on 30th.

BRAEMAR.—A very cold month, and night frosts very damaging. Sunshine 135 hours 40 minutes. On the 22nd the temp. on grass fell to 17°, and icicles were seen nearly five inches long.

ROEBERRY.—A very cold and unsettled month throughout. Mean temp. 45°·3.

IRELAND.

DARRYNANE ABBEY.—A very cold, ungenial month, with a few warm days at the beginning. Vegetation very backward.

WATERFORD, BROOK LODGE.—Frost on the 21st, 22nd, and 23rd, which blackened potatoes, mangolds, heliotropes, beans, &c. The whitethorn blossomed in the most wonderful manner this year. The ash trees were very late coming into leaf. T, L, and heavy H on 29th.

O'BRIENSBRIDGE, ROSS.—Generally. a cold and ungenial month. Hail showers frequent. Sharp frosts on 20th, 21st, and 22nd.

DUBLIN.—This was a cold, changeable month, more like an ordinary March than May. The mean temp. (49°·2) was actually lower than that of April by nearly one degree, and was 7°·5 below that of May, 1893, being fourth in order of coldness in the past 30 years. A solar halo was seen on the 6th. High winds were noted on as many as 11 days, attaining the force of a gale on the 16th. T was heard on the 15th, 29th, and 30th. H fell on the 7th, 20th, and 28th. S and sleet on the 20th. Foggy on the 16th, 17th, and 23rd.

EDENFEL.—A harsh, unnatural, unsatisfactory month, with rainfall above, and temp. below, the average, destroying much of the bright promise of April. There was frost of more or less severity on nine nights in the latter half of the month, that of the night of the 21st having been more destructive in its effects than any frost in May for over 30 years. An unusually luxuriant and prolific vegetation of leaves and flowers was caught at its tenderest period, and plants of all kinds, including young hardy trees and even grass, received a check from which some will never recover, and the rest not during this year.

METEOROLOGI

THE MAY

We revert to this subject not because we wish to insert two last month, but because Mr. I our statement in Section (4), p he quotes facts in support of that truth can be elicited. W that the cause was identical t that the data in our last prove will not do generally. He spe dry N.E. wind," but the Rev on purpose to see what was g wonderfully bright, keen and be interested in Mr. Slade's present leave the subject, wit too late even now to ascertain damage at various heights ab and sheltered from, N.E. wi Microscopical and Natural I shall be happy to place a pa result.

To the Editor of

Sir,—In your "Comment the May Frosts to the radia facilitated by a clear sky an Here the values were :—

May 21st, 1894
,, 17th, 1891
,, 12th, 1888

In 1894, with a differenc and grass, an unprecedente years only slight damage. preceded by cold Aprils, an

On May 1st, 1892,
,, ,, 7th, ,,

April, 1892, was warm–

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXLII.] JULY, 1894. [PRICE FOURPENCE, or 5s. per ann. post free.

THE MAY FROST OF 1894.

WE revert to this subject not only because of its importance, and because we wish to insert two paragraphs which were crowded out last month, but because Mr. Harold Smith quite rightly criticises our statement in Section (4), p. 72. We say "quite rightly," because he quotes facts in support of his views; and it is only by criticism that truth can be elicited. We may have been wrong in assuming that the cause was identical throughout the country, but we think that the data in our last prove that Mr. Harold Smith's explanation will not do generally. He speaks of a "very strong, cold, and very dry N.E. wind," but the Rev. H. A. Boys, who got up at 3.20 a.m. on purpose to see what was going on, says, on page 67, "the air was wonderfully bright, keen and still." We think that Mr. Smith will be interested in Mr. Slade's report from Beckford; and for the present leave the subject, with the suggestion that it is probably not too late even now to ascertain for the vicinity of Kenley the relative damage at various heights above sea level, and at places exposed to, and sheltered from, N.E. winds. If Mr. Smith, or the "Croydon Microscopical and Natural History Club," will undertake this, we shall be happy to place a page or two at their disposal to report the result.

To the Editor of the Meteorological Magazine.

SIR,—In your "Comment No. 4" you attribute the damage done by the May Frosts to the radiation of the heat into space, which was facilitated by a clear sky and is proved by the grass temperatures. Here the values were :—

	Minimum Stevenson stand.	Grass.
May 21st, 1894	30°	27°
,, 17th, 1891	30°	26°
,, 12th, 1888	31°	24°

In 1894, with a difference of 3° between the stand thermometer and grass, an unprecedented damage was done; in the two other years only slight damage. 1888 and 1891, had, however, both been preceded by cold Aprils, and the differences were 4° and 7°.

On May 1st, 1892, min. on stand 31°, on grass 24°
,, ,, 7th, ,, ,, ,, ,, 26°, ,, ,, 18°

April, 1892, was warm—the differences in May, 1892, 7° and 8°

and still no extraordinary damage—but the earliness of the dates may partly account for that.

I think that the damage at Kenley is proved by the above not to have been due to radiation alone; a difference of only 3° does not point to so clear a sky with us, and yet our hardy English trees (Yews, Ashes, Maples and even Oaks) have suffered in a manner I never saw before.

There was one feature in the 1894 frost you do not mention in your comments, which is the prevalence at the time, of a very strong, cold and very dry North-East wind. I am of opinion that that wind was the criminal who robbed us of our garden stuff and spoiled the beauty of our trees. On all the other occasions I have quoted above, the air was comparatively calm.

Probably, first, radiation causes on the foliage a deposit of hoar frost. Second, the sun rises early and melts the hoar frost. Third, the wind blows strongly into the damp foliage, and causes a very rapid evaporation and consequent lowering of temperature in the foliage and young shoots, and to this third cause in my opinion the damage is due.

As an instance of what a cold N.E. wind can do, I relate the following:—In our garden at Hull, we had a small fountain; one winter's morning looking out, I saw large icicles hanging from the upper basin. I, of course, thought there had been a sharp frost, but on consulting the thermometer there had been no frost either on the stand or on the grass. At the time this occurred a strong dry N.E. wind was blowing, and the only cause I could assign for the formation of the icicles was the rapid evaporation caused by the cold, dry wind and consequent abstraction of heat from the trickling water. If the wind could do that, I think it could also cause the damage to vegetation that occurred last month. Please also note air temperatures are mild comparatively to some recorded and yet the damage occurred.

Yours sincerely,

Ingleside, Kenley, Surrey, 19th May, 1894. HAROLD SMITH.

To the Editor of the Meteorological Magazine.

SIR,—Your statements as to the relative severity of the May frosts of 1891 and of this year are borne out by the state of the foliage as seen in travelling between Northallerton and Newcastle. At most spots on that line there is a good deal of brown, yet at least some green tinge is on almost, if not quite every tree; whereas in 1891, many beeches were perfectly brown, the nipping being much more severe in that year. In Cleveland, too, the nipping is very slight; while in 1891 it was severe. Yet the damage to the fruit crop is much greater than in 1891.

In the Swindon district the foliage is almost as much nipped as on the North-Eastern Railway, but I was not in that part in 1891, so cannot compare the two years there.

T. W. BACKHOUSE.

Sunderland, July 7th, 1894.

BECKFORD, GLOUCESTER.—The frost has done immense damage; early potatoes and kidney beans are practically destroyed; plums, strawberries and early peas that were either in blossom or pod have suffered severely, and what on May 20th promised a very good crop, may now be expected to yield less than half an average. The spring-planted beans in the fields, which were half a yard high, bent their heads to nearly touch the ground, and some of the stalks were cracked. This cannot fail to have a bad influence on the crop at harvest. Cherries and apples are also damaged; in short, all kinds of fruit and vegetables have suffered more or less from the severe frosts of May 20th—22nd.

The frost was confined entirely to the valleys and low-lying districts near the rivulets and watercourses. Beckford is 120 ft. above the level of the sea. At Grafton, which is 200 ft. above sea level, scarcely any damage was done; in one or two patches of potatoes only just the tops of the haulm was nipped, and at 30 ft. higher, at the upper end of the village, there was no trace of a frost having occurred. At Cobbler's Quarry, an elevation of 520 ft., the potato haulm and kidney beans exposed to the full blast of the cold north-easterly winds were not even touched by frost. At the Overbury allotments, 330 ft. above sea level, no damage was done; but at the lower end of the village, which is the same elevation as Grafton, just the tops of a few patches of potatoes were scorched.

A line drawn at 230 ft. above sea level—or, what is more to the purpose, 100 ft. above the level of the brook in the valley—would represent the limit of the frost. Above that line no damage was sustained; below that line everything in the shape of fruit and vegetables is more or less affected, the destruction increasing in intensity the nearer the watercourses, where it is indeed lamentable. —*Report for week ending May 24th, by Mr. F. Slade.*

EFFECTS OF THE FROST.—Reports from many counties in England and Scotland testify to serious damage having been done to tender crops by the frosts which occurred at the beginning of last week. The tops of potatoes were blackened in fields and gardens, and in many cases were killed quite down to the ground. French beans were destroyed, and early peas nearly or quite fit for picking were badly injured, while other crops in market gardens were more or less damaged. Early swedes and other turnips, just up, are reported by the *North British Agriculturist* to have been destroyed in Scotland. Some kinds of fruit, too, suffered a good deal in exposed situations from frost, while hailstorms were still more destructive in some parts of the country, cutting the fruit off the trees, and almost stripping them in the worst cases. Where strawberries were forward in the berry stage, as in Kent and other parts of the South, they were spoilt, and hop bines in exposed plantations were injured. Even such forage crops as clover, sainfoin, and vetches were affected in many places. Some of the injured crops will recover, while others, such as French beans and turnips, have been quite destroyed. Potatoes will grow fresh tops, but will be put back a good deal by the necessity of making a fresh start, and will yield badly in the end, or, at any rate, much less than they would have produced if no damage had been done to them. The misfortune is exceptionally partial in its coincidence. The frost was mainly a wind frost, and, therefore, it was most felt in exposed situations; but it was a white frost in some parts of the country, and there its results are as serious in low-lying damp places as where the wind swept over the land without check. On the other hand, many a sheltered garden escaped injury entirely, and a smaller propor-

tion of fields and fruit and hop plantations. Apart from the frosts, the weather during the month now nearly ended has been cold and altogether unpropitious to vegetation, so that the farm outlook has deteriorated in a marked degree. Most of the white-straw crops have now assumed a sickly colour, and peas and beans have suffered quite as much as a rule. Even the hay crop, of which high hopes were raised a month ago, will be much smaller, as well as less satisfactory in quality, than it was expected to prove. Only the hardy varieties of herbage have been able to make much headway during this very unseasonable month of May. Warm weather immediately would do a great deal to restore the hopeful prospects of the early period of spring, but even another week of such low temperature as has been lately experienced would go far towards destroying the hope of a good harvest.—*Standard* (reprinted in *Hereford Times* of June 2nd).

STRAWBERRIES IN 1894.—The season of 1894 has in this locality but one word to describe it—disaster. The greater number of varieties were in full bloom when we experienced a frost, which not only registered 10° at 3 feet from the grass, but which lasted for at least six hours. The consequence was that not only the expanded blooms, but also the majority of the unopened buds, were destroyed, and the few blooms which survived this ordeal have been prevented bringing their fruit to perfection by the extraordinary hot weather and parching winds which have prevailed during the past three weeks.—A. H. PEARSON, Chilwell, Notts, in *Journal of Horticulture*.

ROYAL METEOROLOGICAL SOCIETY.

The closing meeting for the session of this society was held on Wednesday, June the 20th, at the Institution of Civil Engineers, Great George-street, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. H. Scott, F.R.S., read a paper on "Fogs reported with Strong Winds during the 15 years 1876-90 in the British Isles."

In a paper read before the society in June, 1893, the author drew attention to the instances of fog occurring with forces of wind of 6 and upwards on Beaufort's scale, and the present paper gives the results of an investigation of the conditions under which these fogs occurred.

Firstly, the distributions of pressure under which these fogs were reported were examined, in order to learn whether they were cyclonic or anticyclonic.

Secondly, the actual weather reported on each occasion was noted, whether simply "f," or qualified by any other letter, such as "o" "u" "d" "f"—overcast, ugly, drizzle, and fog.

Thirdly, the temperatures were extracted not only for the hour at which the fog was reported to have been present, but also the maximum temperature for the 24 hours to which the observation belonged.

Fourthly, the rain was extracted for the preceding and the succeeding days, except in the case of the 6 p.m. fogs, where only the rain reported at 8 a.m. next morning was tabulated.

It should be remarked that these fogs do not occur with typical anticyclonic conditions inasmuch as a wind force of 6 (Beaufort scale) implies steep gradients, and these are incompatible with an anticyclone. The fogs can occur only on the outskirts of the anticyclone, and as usually cyclones press rather closely upon anticyclones, it was often difficult to decide to which system the reported fog properly belonged. An attempt was, however, made to form a judgment on each case, and the accompanying table shows the number of the fogs attributed to each category and referred to winds from different quadrants.

The total number of strong wind fogs dealt with was 135 :—

Winds from	Cyclonic.	Anticyclonic or doubtful.	Total.
N. to E.N.E.	7	0	7
E. to S.S.E.	13	5	18
S. to W.S.W.	81	14	95
W. to N.N.W.	7	8	15
	Total 108	27	135

It need scarcely be said that in general no precipitation occurs with ordinary fogs. In the case of the strong wind fogs, this is far from being a correct statement, although it is the predominant condition of those classed under anticyclones. Of the 27 cases of the latter class of fog, 21 were dry, or at least unaccompanied by as much as 0·1 in. of rain. Of the 108 cases classed as cyclonic fogs, only 30 were dry to the same extent, and 78 were either accompanied with, or followed immediately by, rain (sometimes heavy) and in 18 cases exceeding half-an-inch. It it therefore evident that the majority of these fogs are essentially wet fogs.

All the cases were picked out in which the temperature at the time the fog was reported, either agreed with the maximum for the day or fell only 1° below it.

Of the 27 anticyclonic fogs, 11 fulfilled this condition, and of the 108 cyclonic fogs 61 fulfilled it. Accordingly, out of 135 fogs, 72 or 54 per cent., occurred with temperatures either agreeing with, or very close to, the maximum for the day.

It appeared interesting to examine into the relation of these strong wind fogs to storms. They sometimes occur with actual gales and there were 11 such instances among the fogs classified as cyclonic. No fewer than 25 cases are put down as "preceding severe gales." That fogs sometimes occur just before gales is well known, They are frequently only the last dregs of a regular anticyclone fog to be dispersed by the incursion of the gale.

The overwhelming majority of these cyclonic fogs with South-westerly winds—81 out of 108—and their much greater prevalence on the south-west coast (Scilly, Pembroke, Prawle Point) than elsewhere, points distinctly to their marine origin. They come in to us from the Atlantic Ocean.

They are apparently very thick mist, or very dense rain, and in the author's opinion, should not receive the name of "fog," but that of "mist."

Captain Wilson Barker said that there is a well marked area between cyclones and anticyclones where fog may be expected and is, with a falling barometer, a good prognostic of wind.

Captain Tissard would have liked some observations at sea to be included in the paper, and thought that more precise definition of fog was wanted; many instances in the paper of fog and drizzle would have been described by seamen simply as dirty weather.

Mr. Charles Harding agreed as to the great need for definitions of fog, mist, &c., and referred to the prognostics of fog in the United States, based on the distribution of pressure and the direction of the wind. He thought that as most of the stations reporting the fogs were on the coast, the temp. of the sea would be an important element.

Mr. Gaster, in referring to the definitions of fog and mist, said there were two classes of phenomena which obscured luminaries. One with low temp., dry air, calm and no sensation of drops of moisture; the other with low barometer, high temp., strong wind and wetness—the only characteristic in common being the obscuration. He thought it most necessary that the two should be distinguished.

Dr. Marcet thought the most striking fact was that the fogs referred to occur so frequently with the max. temp. when one would not expect condensation.

Mr. R. H. Curtis spoke of the confusion between London and country fogs, the irritating properties of fog being entirely due to town products, dry fogs being confined to towns, while country fogs are all more or less moist.

Mr. Symons referred to the great differences of opinion expressed in the previous discussion as to the definition of fog, mist, haze, and raised the question of the adoption of some measure of the intensity of fogs, asking whether two objects at different distances but subtending the same angle would be equally obscured.

Mr. H. N. Dixon said that on land dust nuclei and a saturated atmosphere were necessary for the condensation of mist, while at sea saline particles in the air would induce a fog or mist when the air was not saturated.

Mr. Scott, in replying, said that the Meteorological Office was not responsible for any definition of fog, but that the paper was based simply on the reports of the observers. The limits of an adjoining cyclone and anticyclone are absolutely undefined, and it is at times impossible to state in which a given fog area should be included. As a rule observations were not commenced till the vessels were far from land, so that no records at sea were available for the paper. At Kew *observations* had been made for some time on the visibility of objects

at various distances, but the results were affected enormously by variations of illumination and by the direction of the sun.

Mr. R. H. Curtis, F.R.Met.Soc., read a paper on "Some characteristic features of Gales and Strong Winds." After calling attention to the unsatisfactory state of anemometry, and after describing the "bridled" anemometer at Holyhead, Mr. Curtis stated that the greatest force of an individual gust which he had met with, was registered in December, 1891, and amounted to a rate of 111 miles per hour, which with the old factor would be equivalent to a rate of about 160 miles per hour. Gusts at a rate from 90 to 100 miles per hour have many times been recorded, but the usual limit for gusts may be taken to equal about 80 miles per hour, which on the old scale would be equivalent to about 120 miles per hour. Gales and strong winds differ in character very much, and as the result of a prolonged study of their general features as recorded by the bridled anemometer, the author has been able to group them into three general classes.

The first class comprises those gales which are essentially squally in character—in which the gusts constitute the main feature of the gale. In such a case the squalls and lulls alternate very rapidly, and indeed the wind is never constant in force for many seconds together. Usually it oscillates over a range of perhaps 10 or 20 miles at a mean strength of perhaps 40 miles per hour, but every now and again it bursts out with a velocity of perhaps 40 or 50 miles an hour above the average, and after a few seconds sinks to a rate of 10 or 20 miles below it. This is certainly the most usual character of the gales experienced on our coasts, although they vary immensely as regards the strength and frequency of the gusts and lulls, and also as to the average velocity which may be called the "normal of the gale."

The second class of gales is that in which the velocity of the wind is tolerably steady, much steadier than in the first. The "normal" of the gale covers a much smaller range, perhaps not more than a rate of five or six miles per hour, and the squalls are far less severe; and I have noticed that generally they are not accompanied by lulls falling much below the "normal," or if the lulls are frequent then the squalls above the "normal" are comparatively few. This is a rather curious feature, but I have noticed it in several cases.

The third class should perhaps have been the second, inasmuch as it is a distinctly squally variety of gale. But the characteristic by which it is distinguished is peculiar. The record made by the anemometer has two "normals," connected by a lighter band of shading. Indeed the gale appears to be made up of two series of rapidly succeeding squalls, the one series at a comparatively low rate of velocity, the other at a much higher one, the wind force shifting rapidly and very frequently from the one series to the other.

On looking carefully over the records, the author found, often-

times very distinctly marked, a long pulsation in the wind force which recurs again and again with more or less regularity at intervals of perhaps 20 minutes or half-an-hour in some cases, and in others at longer intervals of about an hour, more or less.

SUN SPOTS AND AIR TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—A.B.M. is persevering. He now, in your number for April, suggests, in regard to sun spots and air temperature, a difference in the summer and winter effects, and thinks that I have assumed that these must necessarily be similar. Not at all. The essence of my comparison was that January was compared with January, February with February, and so on. This should bring out any possible different effect at different seasons of the year. But to save space I did not, in the communication printed in your March number, give all the figures that might have been presented. Of the four columns of temperature there included, two refer to sun spot minima, and two to sun spot maxima, equally distributed, and therefore all equally representative (as regards sun spot influence) of the complete period discussed, 1763 to 1892, no monthly mean depending on less than five epochs of minima or maxima. I there compared Min. No. 1 with Max. No. 1, and Min. No. 2 with Max. No. 2. I now repeat these, giving in addition comparison of Min. No. 1 with Max. No. 2, and Min. No. 2 with Max. No. 1 :—

Month.	Min. No. 1 above Max. No. 1.	Min. No. 2 above Max. No. 2.	Min. No. 1 above Max. No. 2.	Min. No. 2 above Max. No. 1.
	°	°	°	°
January	−0·13	+0·48	+0·75	−0·40
February	−0·85	−0·32	−0·42	−0·75
March	−0·17	−0·92	−1·54	+0·45
April	+1·88	−0·38	−0·81	+2·31
May	+1·04	−0·51	−0·43	+0·96
June	+1·11	+0·88	+0·81	+1·18
July	+0·95	−1·45	−0·69	+0·19
August	+1·10	−0·81	+0·01	+0·28
September	+2·15	+0·35	+1·04	+1·46
October	+1·66	−1·31	+0·55	−0·20
November	+2·18	+0·13	+0·43	+1·88
December	−0.21	−0·02	−0·53	+0·30
The Year	+0·88	−0·32	−0·07	+0·63

The discordance between the four values, exhibited in individual months, arising probably from general irregularity of temperature due to various causes, seems to render it hopeless to endeavour from discussions of this nature to evolve any definite sun spot effect.

W. E.

June 18th, 1894.

THE ANTWERP CONGRESS.

IN connection with the International Exhibition now being held at Antwerp, there is to be on August 16th to 18th a congress of persons interested in the Science of the Atmosphere.

The General Secretary has requested us to bring the subject before our readers, and we have much pleasure in complying with his wish.

The aim of the Congress is not so ambitious as is its title. The Congress will be divided into two sections; the first will deal with:—

1. General theory of the currents of the atmosphere and of their causes.
2. Methods of observation at various altitudes.
3. Instruments, recording apparatus, &c.
4. Maps of the permanent and variable currents of the atmosphere and comparison with those of the oceans.

The second section will deal with Aerodynamics, divided as follows:—

1. Measures of the velocity of the wind.
   Actions on plane and inclined surfaces; friction; experimental apparatus; effect of wind on bridges, buildings, towers, &c.; wind as a motor; aeroplanes, windmills, turbines, ship's sails; wind as a retarder of motion; transport by land, by sea, and by air.
2. Application of ascertained facts to the problem of Ærial navigation; Ærial propulsion by wheels, helices, &c.

We understand that the Congress will be under Royal Patronage, and if we may judge of all the officers by the two whom we know, they are probably the best of the country; for the President of Section 1 is M. Lancaster, Meteorological Inspector at the Royal Observatory, the well-known Astronomical Bibliographer and Editor of *Ciel et Terre*; and he is supported by M. Vincent, also of the Royal Observatory, who acts as Secretary.

The circular points out that while the problem of ærial navigation is the leading one for consideration, many other questions will be considered, and knowledge will be gained as to the motion of upper clouds, as to the effect of wind upon buildings, as to weather-forecasting and other matters, and, moreover, as there will be some other congresses in session at the same time, there will be various fêtes and public functions at which the members can be present.

The Committee invite communications, and members—Gentlemen's tickets 10 fr. (including a copy of the vulume when published). Ladies' tickets 5 fr.

We wish the meeting good success, and conclude by giving the address of the General Secretary, to whom all communications and enquiries should be addressed.—Monsieur le Chevalier Le Clement de Saint Marcq, Rue du petit Chien, 16, Anvers.

SHORT NOTES.

A WHIRLWIND IN SURREY.—Mr. Sidney H. Burchall writes from Reigate under date of June 21st: Whilst standing to-day in an open hay field, situated about a mile south of this town, I and others witnessed what may be described as a whirlwind, but of such unusual character that it may perhaps be worth recording. The field lies on high ground, exposed to the south, and at the time of my visit about one o'clock, several men were engaged in turning over a heavy crop of hay. The day had been a brilliant one, and was then very warm, and I could not perceive any movement of the trees which bounded the field on the east and west sides. Without warning an extraordinary whirlwind broke on the field within a few yards of where I stood, catching up the hay with violence. For some moments the air was filled with wisps of hay, whirling in rapid movements, and in circles gradually getting larger and larger as they rose in the air; but, what was so striking, rising to a great height. At the same time that this happened several rooks were passing. These appeared also to be caught by the tornado, and were likewise carried up to a great elevation; in fact, until I could no longer follow them. The passage of the storm was from west to east, but it seemed to travel very slowly, and was ultimately dispelled by the trees at the opposite end of the field.

The above is of interest as giving (unconsciously) a graphic picture of the cause of the formation of whirlwinds. An open field, high and exposed to a brilliant sun, the air calm and very warm, therefore expanded and of light specific gravity, hence unstable equilibrium, suddenly broken with the inevitable result of circular motion and the lifting of light objects like the hay.

HARVEST WEATHER FORECASTS.—For some years the Meteorological Council (the Government Office be it understood—not the Council of the Royal Meteorological Society) have during the summer issued forecasts of what they expected the weather to be. These telegrams are sent at the public cost to certain counties so that their value or otherwise may be demonstrated. The following cutting from the *Ayrshire Observer* gives a general idea of the local arrangements.

CUMNOCK.—WEATHER TELEGRAMS.—The first of these telegrams, which are to be sent out by the Board of Agriculture for the next eight weeks, reached the Post Office here and was displayed in the window about 4 p.m. on Wedday, June 27th. These weather warnings are being sent to all the telegraph Post Offices in Ayrshire and Haddingtonshire, and are meant to be of use to farmers in ordering their operations during the hay and grain-crop harvests. It should be borne in mind that the prognostications of the kind of weather which is likely to be experienced always refer to the day succeeding their arrival, and should be studied that night or next morning; and if the morning, then of course they refer to the day then entered upon. Most certainly they are well worthy the attention of farmers, for, as a rule, they will be found to foretell the weather with remarkable correctness. In every district a person has been appointed to keep a daily register of the weather actually experienced, *and which, at the* end of the eight weeks, will show how far these forecasts

have been acurate and may in future be depended on. "Our own Correspondent" of many years on "Weather, Farming, &c," has been appointed to keep the register here, and from the deep interest he has long taken in the subject, it is sure to secure his closest attention. These forecasts have commenced two full weeks too early for Scotland, and ought to have continued till the end of September, it being very seldom that the grain-harvest is over before that time. Ending, as is proposed, about the middle of August, hardly any crops will be reaped at that date. The Board of Agriculture ought to have consulted some leading agriculturists in Ayrshire and Haddingtonshire on the matter.

INJURY BY LIGHTNING.—Mr. Alfred Littlejohn, of The Bounds, Hernhill, near Faversham, Kent, writes of an extraordinary occurrence which took place in his farmyard during the recent thunderstorm. He says: "It may interest your readers to know that during the severe thunderstorm I had 100 head of poultry struck by lightning, three-parts of which were Aylesbury ducks, and the remainder young chickens. They were in a cherry orchard, with plenty of shelter, but were found early this (Saturday) morning lying about in all directions. They seemed to have been struck in the eye, as in most cases there was a black mark which extended about a quarter of an inch each side of the orbit, and had enlarged the pupil to a very great extent." The incident shows the necessity of ducks and chickens carrying about their own lightning conductors.—*Daily Telegraph, July 10th*, 1894.

This may well be described as an "extraordinary occurrence." Much additional information is desirable—*e.g.* Were any of the trees struck? Were the chickens mostly found under the trees? Was every one of the 100 killed; or were there more than 100 in the orchard, and only 100 killed; *i.e.*, were there any survivors?

THE SUNSHINE OF 1893.—The number of hours of bright sunshine recorded at Greenwich during 1893 by the Campbell-Stokes sunshine instrument was 1,454, the greatest number on record since the commencement of the registration in 1877. This is 171 hours above the average of the preceding 16 years, after allowance is made for the small difference of indication of the Campbell and Campbell-Stokes instruments. The aggregate number of hours during which the sun was above the horizon was 4,454, so that the mean proportion of sunshine for the year was 0·326, constant sunshine being represented by 1.

A WEATHER PROPHECY.—"July will be a dry month, and there will be very few days with a maximum temperature under 70°, and at times it will exceed 90°."—*Hugh Clements in "Hereford Times" of July 7th.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1894.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	52·0	11*a*	13·1	5	43·2	32·6	34·8	87	76·8	14·3	2·87	25	7·1
Malta	63·8	25	42·0	18	59·1	47·4	46·0	84	114·2	35·5	4·00	19	7·2
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	86·4	6	71·0	17	83·1	73·7	70·0	78	137·6	65·1	14·58	20	6·6
Calcutta	84·1	22	50·1	9	78·1	55·7	55·7	71	135·1	41·0	·00	0	6·6
Bombay	87·3	7	65·8	5	83·1	68·7	64·8	69	132·2	57·0	·22	1	0·3
Ceylon, Colombo	90·1	16	66·0	29	87·0	70·9	68·4	74	153·5	54·0	·62	5	4·4
Melbourne	102·5	21	52·0	15	80·2	58·6	57·4	69	149·2	45·6	·47	8	4·5
Adelaide	105·7	2	50·2	16	86·4	60·7	52·1	47	164·5	43·2	·68	4	2·7
Sydney	97·0	12	60·5	20	78·5	66·3	62·6	72	155·6	49·9	1·61	19	6·7
Wellington	80·0	13*b*	44·0	30	71·9	58·4	55·9	73	145·0	30·0	6·84	11	4·6
Auckland	82·0	27	50·0	30	75·0	62·4	61·2	79	148·0	47·0	2·68	...	4·8
Jamaica, Kingston	89·0	30	64·3	19	84·8	66·7	65·2	76	...	...	·19	4	3·5
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	47·3	4	10·3	25*a*	34·5	22·1	24·3	81	...	4·0	1·67	17	7·0
New Brunswick, Fredericton	49·8	25	—30·5	11	23·4	— 1·9	9·7	80	...	...	2·99	13	5·0
Manitoba, Winnipeg	39·0	13	—46·1	24	4·9	—18·3	...	...	...	...	1·16	...	5·0
British Columbia, Esquimalt	51·0	14	24·3	6	41·4	32·9	35·0	91	...	...	7·24	21	8·0

a And 27. *b* And 15.

REMARKS.

MALTA.—Adopted mean temp. 52°·5; mean hourly velocity of wind 7·8 miles. TS on 12th, 27th, and 30th. L on 6 days. H on 5 days. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·5 below, dew point 0°·2 above, and rainfall 7·07 in. above, their respective averages. Mean hourly velocity of wind 13·5 miles, or 2·2 above average; extremes, 41·0 on 13th, and 1·9 on 16th; prevailing direction, E.S.E. to E. by N. L on 2nd, T on 8th, and T and L on 28th. Disturbed weather from the 9th to the 14th, during which a cyclone passed E. and S.E. of Mauritius. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 12th. D. G. MANTELL.

Melbourne.—Lightning on the 3rd, 13th and 25th; thunder on the 6th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·8 below the average of 37 years. Rainfall ·15 in. below the average. First half of the month very cool, latter half very hot.—C. TODD, F.R.S.

Sydney.—Weather generally hot and dry. H. C. RUSSELL, F.R.S.

Wellington.—Showery for first few days, wind S.E., then fine weather, with moderate N.W. wind, until the night of the 16th, when it came on from N.W. and continued until 19th, wind changing to S.E., 2·22 in. rain recorded on the 18th. Fine from 20th to 24th, then showery for remainder of month. Prevailing N.W. wind, and generally moderate. On the whole pleasant and warm weather. Slight earthquake on 11th at 10.15 p.m. R. B. GORE.

Auckland.—On the whole an average and seasonable month. Mean temp. slightly in excess of the average of the previous 27 years. Rainfall slightly below the average. T. F. CHEESEMAN.

JAMAICA.—Rainfall one-seventh of the average. Mean hourly velocity of wind *2·9 miles.* For the whole Island the rainfall was only one-half the average. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·75	XI.	Rhayader, Nantgwillt..	2·55
,,	Birchington, Thor	1·90	,,	Lake Vyrnwy	3·08
,,	Hailsham	1·64	,,	Corwen, Rhug	1·24
,,	Ryde, Thornbrough	1·86	,,	Carnarvon, Cocksidia ...	1·97
,,	Emsworth, Redlands ...	1·80	,,	I. of Man, Douglas	3·41
,,	Alton, Ashdell.....	2·40	XII.	Stoneykirk, Ardwell Ho.	3·87
III.	Oxford, Magdalen Col...	2·77	,,	New Galloway, Glenlee	3·25
,,	Banbury, Bloxham	1·87	,,	Melrose, Abbey Gate ...	3·38
,,	Northampton, Sedgebrook	2·18	XIII.	N. Esk Res. [Penicuick]	3·10
,,	Alconbury	2·10	,,	Edinburgh, Blacket Pl..	2·65
,,	Wisbech, Bank House..	2·67	XIV.	Glasgow, Queen's Park.	2·76
IV.	Southend	2·28	XV.	Inverary, Newtown	4·42
,,	Harlow, Sheering	2·05	,,	Islay, Gruinart School..	·83
,,	Colchester, Lexden.....	2·01	XVI.	Dollar.....	2·99
,,	Rendlesham Hall	2·81	,,	Balquhidder, Stronvar..	3·51
,,	Diss	2·16	,,	Ballinluig	1·92
,,	Swaffham	2·92	,,	Dalnaspidal H.R.S. ...	2·86
V.	Salisbury, Alderbury...	2·29	XVII.	Keith H.R.S.	1·54
,,	Bishop's Cannings	2·82	,,	Forres H.R.S.	1·38
,,	Blandford, Whatcombe.	2·88	XVIII.	Fearn, Lower Pitkerrie.	1·54
,,	Ashburton, Holne Vic....	2·51	,,	Loch Shiel, Glenaladale	...
,,	Okehampton, Oaklands.	2·43	,,	N. Uist. Loch Maddy ...	2·37
,,	Hartland Abbey	2·05	,,	Invergarry	2·05
,,	Lynmouth, Glenthorne.	1·79	,,	Aviemore H.R.S.	1·68
,,	Probus, Lamellyn	2·05	,,	Loch Ness, Drumnadrochit	1·66
,,	Wellington, Sunnyside..	1·76	XIX.	Invershin	1·59
,,	Wincanton, Stowell Rec.	2·86	,,	Scourie	1·90
VI.	Clifton, Pembroke Road	2·41	,,	Watten H.R.S.	1·55
,,	Ross, The Graig	1·76	XX.	Dunmanway, Coolkelure	3·36
,,	Wem, Clive Vicarage ...	2·68	,,	Fermoy, Gas Works ...	1·88
,,	Cheadle, The Heath Ho.	2·51	,,	Killarney, Woodlawn ...	2·57
,,	Worcester, Diglis Lock	2·07	,,	Tipperary, Henry Street	2·19
,,	Coventry, Coundon	1·93	,,	Limerick, Kilcornan ...	1·98
VII.	Ketton Hall [Stamford]	1·98	,,	Ennis	...
,,	Grantham, Stainby	1·88	,,	Miltown Malbay.....	3·08
,,	Horncastle, Bucknall ...	2·50	XXI.	Gorey, Courtown House	2·70
,,	Worksop, Hodsck Priory	2·25	,,	Athlone, Twyford	2·26
VIII.	Neston, Hinderton	2·14	,,	Mullingar, Belvedere ...	2·58
,,	Lancaster, Rose Bank...	2·81	,,	Longford, Currygrane...	1·84
,,	Broughton-in-Furness..	5·01	XXII.	Galway, Queen's Coll...	2·75
IX.	Ripon, Mickley	3·76	,,	Crossmolina, Enniscoe..	3·04
,,	Scarborough, South Cliff	4·24	,,	Collooney, Markree Obs.	2·52
,,	East Layton [Darlington]	4·00	,,	Ballinamore, Lawderdale	2·40
,,	Middleton, Mickleton..	3·19	XXIII.	Lough Sheelin, Arley ..	1·89
X.	Haltwhistle, Unthank..	3·89	,,	Warrenpoint	2·48
,,	Bamburgh.....	2·09	,,	Seaforde	3·92
,,	Keswick, The Beeches...	3·86	,,	Belfast, Springfield	4·25
XI.	Llanfrechfa Grange	2·59	,,	Bushmills, Dundarave...	2·10
,,	Llandovery	2·63	,,	Stewartstown	3·24
,,	Castle Malgwyn	1·74	,,	Buncrana	2·19
,,	Builth, Abergwessin Vic.	3·48	,,	Lough Swilly, Carrablagh	2·24

METEOROLOGICAL NOTES ON JUNE, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The first half of the month was showery but warm, and the close of the month was very hot. All agricultural crops looked extremely well, and with an experience of 36 years I never saw the corn so fine. Hay very abundant and carried in the finest possible weather.

ADDINGTON.—From the 1st until the 21st dull and unsettled, from that date until the end, very fine; first rate weather for hay making. The last day of the month was very hot, although a brisk N.E. wind was blowing all day.

BURY ST. EDMUNDS.—Cold and wet till the 21st, then fine summer weather till the end of the month. The last week was very favourable for hay making. Distant T on 20th.

NORWICH, BRUNDALL.—Weather very cloudy and unsettled, with frequent R, during the first three weeks. The last ten days very fine and sunny, with heat tempered by a sea breeze from N.E. Strawberries ripe on 16th, or three weeks later than last year. Corn in ear on 21st. T and L on 5th, 15th, 18th, and 20th. Almost continuous R for 80 hours from 8th to 11th.

LANGTON HERRING.—From the beginning of the year to the end of June R fell on 100 days; this is the greatest number of rainy days in the first half of any year of the last 20, and is 22 above the average. Up to the 23rd the weather was cold and unsettled, but the last week of the month was fine and very hot and most favourable for securing the hay crop, which was exceptionally heavy. The mean temp. at 9 a.m. (59°·0) is 1°·3 below the mean of 22 years. Fogs were frequent. Solar halos were observed on the 12th and 16th.

TORQUAY, CARY GREEN.—Rainfall ·02 in. below, and wet days 1 above, the average. Mean temp. 57°·8, or exactly the average. Amount of sunshine 184 hours 30 min., being 41 hours 30 min. below the average. Two sunless days.

STROUD, UPFIELD.—T and heavy R in early morning on 3rd.

WOOLSTASTON.—A splendid month for the hay harvest. The early part was rather cold, but the last fortnight was very dry and hot. Mean temp. 56°·3.

TENBURY, ORLETON.—Very cold and wet till the 14th, then finer, the last week being brilliant, hot weather. Mean temp. for the month about 0°·5 below the average. T and L on 4th.

LEICESTER, BARKBY.—Chilly and drizzly during the first fortnight, then dull and cloudy till the last few days, which were hot and cloudless. Mean temp. for the month 58°·2.

MANCHESTER, PLYMOUTH GROVE.—The coldest June experienced since observations commenced 27 years ago, with the one exception of June, 1871, when the mean temp. was 54°. Weather up to the 25th very unsettled and unseasonable; from 26th to 30th fine and summer-like. Mean temp. 55°·5.

WALES.

HAVERFORDWEST.—Up to the 26th there really was no day that could be called a summer day, and the shade temp. three times fell as low as 37°. On 26th the wind shifted to E., with sudden heat and bright sunshine to the end of the month. The keen frosts of the last days of May checked vegetation to such an extent as to dishearten those engaged in gardening and agriculture. The ash and oak—the former particularly—were brought almost to a standstill in putting forth their leaves, and in many places looked black and blasted. Fruit will not be nearly so abundant as was expected earlier. Corn looking well, and hay crops will be fully up to the average. Heavy TS at 3 a.m. on 3rd.

GOGERDDAN.—Very stormy and dull during the first three weeks of the month, but very hot, with bright sunshine, in the last week.

SCOTLAND.

CARGEN.—The mean temp. of the month was a little more than 2° below the average. The first 25 days were unusually cold, the mean temp. for that period being 4°·2 below the average for June. The last five days were very warm, the max. on the 30th being, with two exceptions, the highest recorded in June during 34 years. The range of temp. (48°) was unusually great. Light winds, mostly easterly and northerly, prevailed, with dull, wet weather, the hours of sunshine being greatly below the average. T on 1st.

JEDBURGH.—The weather of more than the first half of the month was cold and ungenial, with low night temp.; but as there was a good deal of sunshine, vegetation progressed fairly. The heat of the last week was great. Prevailing winds E., N.E. and S.E. The apple blossom was completely destroyed by the frosts at the end of May.

COLMONELL.—Mean temp. 54°·8, being 1°·9 below the average of 18 years.

BRAEMAR.—Cold and unsettled, with frosts up to the 26th, afterwards hot and dry. Duration of sunshine 158 hours.

ROEBERRY.—The first half of the month was cold and dry, the latter half warmer. Mean temp. 52°·9, 1° below that of June, 1893.

IRELAND.

DARRYNANE ABBEY.—The first half of the month was cold and wet, the third week very foggy, and the end fine and hot.

O'BRIENSBRIDGE, ROSS.—Summer weather commenced on the 26th. T on the 4th.

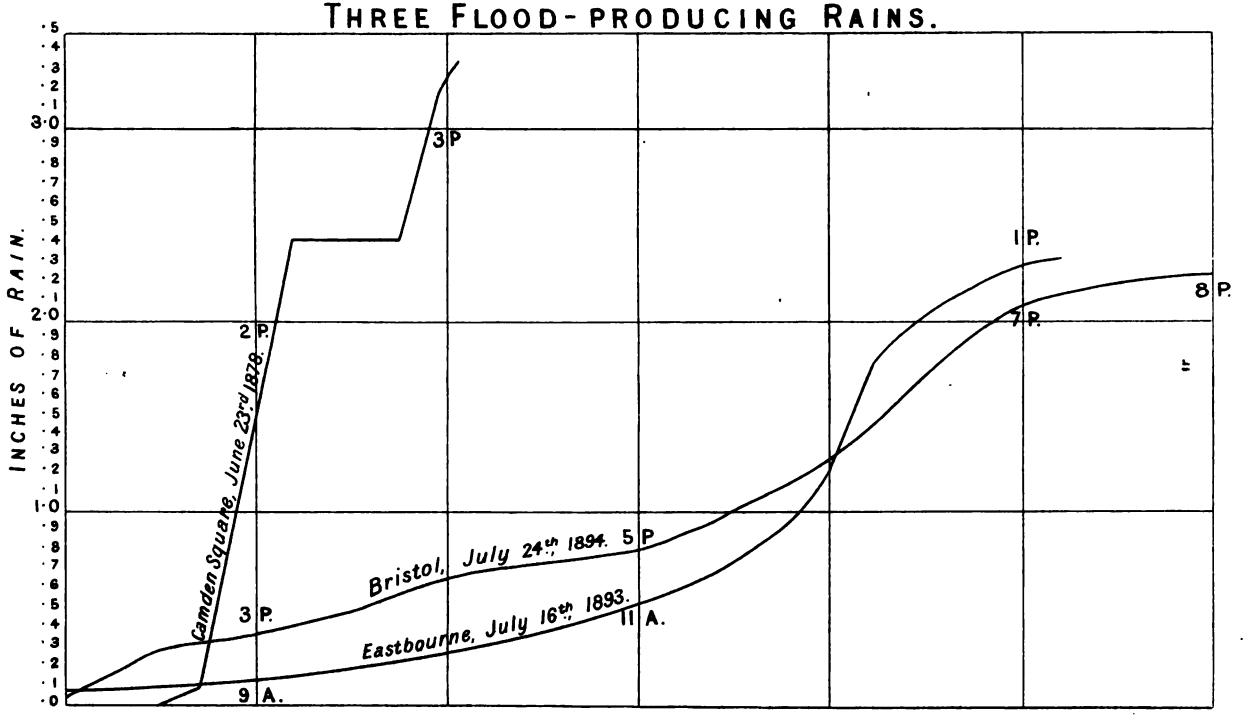
DUBLIN.—Although somewhat cloudy and rather cool, this proved a favourable month, and its closing days were exceptionally warm and brilliant. The rainfall was frequent, but not heavy, and a decided advance in the night temperature was perceptible as compared with the frosty May. No electrical disturbances occurred. Mean temp. (57°·0) 0°·8 below the average. High winds were noted on 9 days, attaining the force of a gale on the 23rd. Temp. reached or exceeded 70° in the screen on only 2 days. H fell on the 10th and 18th; fog occurred on the 3rd, 4th and 9th.

EDENFEL.—With the exception of the last few days, the weather possessed most of the unfavourable characteristics of May—great absence of sunshine, with temp. considerably below, and rainfall rather above, the average. The excess of R for the six months amounts to 8·02 in. On the 27th a brilliant hot spell of summer weather set in, breaking again, however, on the night of July 1st.

TWO RECENT RAINS.

AT Camden Square we had a sharp thundershower on July 9th; the total fall was less than a quarter of an inch, but the fall was very heavy while it lasted. Rain began at 10·47 a.m., and in successive minutes the fall was ·05, ·03, ·02, ·01, ·01, ·02, ·02, ·02, ·02, or ·20 in. in nine minutes.

On the evening of July 10th rain began a little before 7 p.m., and the following was the fall in successive hours:—·08, ·10, ·13, ·15, ·21, ·17, ·14, ·04, ·08, ·02, or 1·12 in. in 10 hours. The fall was much heavier in the neighbourhood of Brighton. The following returns have been received:—Surrey House, Littlehampton, 2·25 in.; Ditchling, Hassocks Gate, Sussex, 2·13 in.; St. Martin's, Guernsey, 2·06 in.; Benenden, Kent, 1·67 in.; Chiddingfold, Godalming, Surrey, 1·47 in.; Tenterden, Kent, 1·04 in.; Emsworth, Hants, ·99 in.


THREE FLOOD-PRODUCING RAINS.
INCHES OF RAIN.
Camden Square, June 23rd 1878.
Bristol, July 24th 1894.
Eastbourne, July 16th 1893.
9 A.
2 P.
3 P.
3 P.
5 P.
11 A.
1 P.
7 P.
8 P.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXLIII.] AUGUST, 1894. [PRICE FOURPENCE, or 5s. per ann. post free.

RAINFALL AND FLOOD AT BRISTOL.

IT is rather singular that in *British Rainfall*, 1893, there are given details of a great rain at Eastbourne in 1893, and that before the volume has been received from the binders, we have the details of a remarkably similar one at Bristol. The Docks Engineer, Mr. J. M. McCurrich, M.I.C.E., has kindly favoured us with a copy of his report and a diagram showing the half-hourly reading of the storm rain gauge at the Cumberland Basin. We give the report verbatim, and reproduce the diagram, but have altered the scale to that adopted in *British Rainfall*—viz., one inch to represent one hour of time and one inch of rain. Diagrams are most useful, but unless great care is used to secure uniformity in the relations between the scales for time and for the phenomena represented, diagrams will suggest false ideas. On the diagram given herewith we have not merely adhered to the scale adopted in *British Rainfall*, but we have reproduced two of the rains there represented so as to facilitate comparison.

We now give Mr. McCurrich's report, which we have broken up into numbered paragraphs for the convenience of reference from the few notes which we have added at the end.

1. The rainfall on Tuesday, July 24th, was so exceptional that I think it well to make a short report upon it.

2. The rain began to fall about 1.30 p.m., and continued without intermission until nearly 10 p.m. The total rainfall between 1.30 p.m. and 10 p.m. was 2·47 in., and the total up to 12 p.m. was 2·53 in. Between 3 p.m. and 7 p.m. 1·80 in. fell. The rainfall between 6 p.m. and 7 p.m. was the heaviest, being ·52 in the first half-hour, and ·35 in the second half-hour, making a total of ·87 in. during the hour.

3. Mr. Francis Fox, in his report of August 27th, 1889, to the Bristol Town Council, on the prevention of Froom floods, said that from data furnished to him by Mr. Robert F. Sturge, Fellow of the Royal Meteorological Society :—"It is seen that in August, 1865, 2·90 in. fell in 15 hours, of which quantity about 2¼ in. fell in four hours. Later in the same month 1½ in. of rain fell in seven hours. In June, 1884, 2·40 in. fell in 10½ hours. In March, 1889, nearly three inches fell in 48 hours, of which about 1½ in. fell in eight hours.

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are collected at the end of the year; but probably Mr. McCurrich's inference is correct, as we hear from Miss Fry that 2·65 in. fell at Failand House, while at the Fishponds Mr. Harding recorded only 2·01 in. The absence of serious flooding (such as Bristol has often suffered from) is due to the fact that it was a local rain, and not a general one over the watersheds of the Avon and the Froom.

HEAVY RAIN AND HAIL STORMS, JULY, 1894.

To the Editor of the Meteorological Magazine.

SIR,—A remarkable hailstorm visited us on July 2nd. The morning was bright and extremely hot, the thermometer marking 85° at 10 a.m.; the maximum of the day was only 1° higher (86°). At 1.40 p.m. a violent and sudden squall brought with it from the S.E. such a thunder and hailstorm as I do not remember to have seen before in my rather long experience. The curious uniformity in size, form, weight, and general appearance of the hailstones was most interesting, and a description of them may enable some of your correspondents to build theories as to their formation. Each stone was of a double convex form, slightly flattened at the poles, and surrounded by a zone of transparent ice, arranged in spiculæ or minute plates, and projecting about the eight of an inch from the equatorial level. This zone was, as I have said, transparent, while the body of the stone resembled frosted or finely-ground glass. The long diameter varied from an inch to an inch and a-half, including the zone, and the short diameter was about three-quarters of an inch. Nine of them weighed exactly 320 grains, or nearly 35½ grains each.

About a mile to three miles west of us the storm was still heavier, judging from the mischief done. Much glass was broken, fruit trees were knocked to pieces, and looked next day as if they had been scorched; wheat and beans were decapitated, and a large tree was shivered to atoms by lightning, about a mile to our N.E. After the storm the sky remained overcast, but the days preceding and succeeding it were fine and bright.—Very faithfully yours,

THOMAS E. AMYOT.

Diss, Norfolk, August 5th, 1894.

To the Editor of the Meteorological Magazine.

SIR,—On Saturday, the 21st inst., we experienced the heaviest rain-storm I have ever witnessed in this locality. Thunder was heard at 3.50 p.m. (after a fine and warm day), and almost exactly at 4 o'clock the rain commenced, descending in sheets and torrents, mingled with hailstones of large size, for about 20 minutes, when its violence somewhat abated, rain entirely ceasing at 4.30 p.m.

On emptying the gauge, I measured *over one inch* (exact amount, 1·02 in.) as the product of this extraordinary shower, and I cannot

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help thinking that this amount, large as it is, may be really less than the true rainfall, for there was very probably some loss due to out-splashing in so violent a fall. I may add that the roads near this house were completely flooded, and washed completely bare, the "oldest inhabitants" of the adjacent village declaring they had never seen such a shower before. The storm, or cloud-burst, was very local. It appeared to travel from almost due south to north, and at a place under two miles from here (in a N.W. direction) *no rain fell during the afternoon*, and hay was being carried all evening.—Yours truly,

B. T. GRIFFITH-BOSCAWEN.

Trevalyn Hall, Rossett, Denbighshire, July 28th, 1894.

To the Editor of the Meteorological Magazine.

SIR,—Finding in this morning's *Times* no account of the storm of yesterday, I conclude that it was of small area, and perhaps at its heaviest here. If so, you may like to hear of it. The morning of July 29th was bright at intervals, though rather hazy, with barometer falling slightly from 30·10 in. to 30·05 in., but there was nothing to indicate the approach of any great disturbance. About 10.30 a.m. the sky began to darken, especially in the N.E., but without any perceptible wind. A few very large drops fell about 11.45 a.m., and the rain began in earnest about 12.15 p.m. In a few minutes the downpour was as heavy as any I have ever watched, and almost, if not quite, vertical, while the size of the drops was remarkable, as well as their close contiguity. But I saw no hail, though some hail is said to have fallen at Strawberry Hill; neither was the lightning very vivid. In fact, I saw no lightning in the early part of the downfall, and probably there were not from first to last more than thirty flashes visible here.

The storm, which had approached us from N.E. and passed very slowly, began to return from W. at about 12.45 p.m., as was manifest from the inclination of the drops, which had hitherto been vertical. But from whatever quarter it descended, it scarcely ever slackened for one instant, until at about 1.20 p.m. the sky towards the south began to brighten, and the clouds went slowly northwards.

The bulk of it was down by this time, and I measured 1·94 in. at 1.30 p.m., that amount having fallen in an hour and a quarter. There was still some short lightning and sharp thunder in the north, where the blackness of the storm now lay; and presently up it came again, but most of its burden had been discharged.

The entire fall up to 9 a.m. July 30th was 2·26 in., which is, I think, the heaviest in my record, beginning in September, 1866. —Faithfully yours,

R. D. BLACKMORE.

Teddington, July 30th, 1894.

RAIN OF JULY, 1894, IN THE S.E. OF ENGLAND.

THE rainfall of July having been exceptionally heavy in the South-Eastern Counties of England, we have, in addition to the usual tables, extracted from the returns received all falls exceeding five inches, and tabulated them with the difference from the average of the ten years, 1880–89, where the records extend over that period.

It will be seen that in every case the total fall for the month is considerably more than twice the average:—

STATION.	COUNTY.	Total Fall. in.		Difference from the average. in.
Teddington	Middlesex	5·95	...	+ 3·46
Abinger Hall	Surrey	5·66	...	+ 3·12
Benenden (East End)	Kent	5·33	...	+ 3·06
Tenterden	,,	5·26	...	+ 2·91
Cranbrook (Hartley)	,,	5·63	...	+ 2·93
Hythe	,,	5·64	...	+ 3·02
Paddock Wood (Capel)	,,	5·50	...	—
Steyning	Sussex	6·56	...	+ 3·83
Hailsham	,,	6·12	...	+ 3·58
Ditchling	,,	6·25	...	—
Niton (St. Catherine's Ho.).	Hants	5·32	...	—
Ryde (Thornbrough)	,,	5·26	...	—
Emsworth (Redlands)	,,	5·14	...	—
Liss (Lingwood)	,,	5·63	...	—
Alton (Ashdell)	,,	5·36	...	+ 2·86

Abinger Hall.—Two heavy falls of rain occurred, without thunder, viz.: 1·55 in. on 10th and 1·46 in. on 29th. G. PAYNE.

Benenden, East End.—1·22 in. fell on 6th, 1·18 in. on 10th and ·93 in. on 29th. At *Rolvenden*, 1·44 in. fell on 6th, 1·26 in. on 10th, and 1·03 in. on 29th. J. ELLIS MACE.

Tenterden.—The largest fall for July during 32 years, the next largest being 5·08 in. in 1888. Thunderstorms on 24th and 29th. J. ELLIS MACE.

Cranbrook, Hartley.—Total fall 2·97 in. more than the average of 25 years, and only once exceeded in 29 years, namely in 1888, when 5·73 in. fell. On 6th 1·48 in. fell, on 10th 1·36 in., and on 29th ·73 in. In the 28 days ending August 7th the fall was 6·20 in. GEORGE PILE.

Ditchling.—Fine and warm till the 6th, when a severe thunder storm occurred, and the rest of the month was very wet and dull. The falls of rain on 10th (2·13 in.) and 29th (1·82 in.) were exceptionally heavy. F. H. PHILLIPS.

Liss, Lingwood.—The heaviest fall yet recorded here (2·00 in.) fell on the 30th, and 1·05 in. fell on 11th. ROBERT BARNES.

THE MAY FROST OF 1894.

To the Editor of the Meteorological Magazine.

SIR,—I note your criticism on my criticism, and thank you for the same. I had not overlooked what the Rev. Mr. Boys reported. I do not myself think that what he says at all upsets my theory. I think that, if inquired into, it may be found only to confirm my idea. Mr. Boys simply says "there was no wind at 3.20 a.m.;" my theory is that the damage was done by the wind after sunrise. Mr. Boys should say what happened after sunrise, say at 5 or 6 a.m. He speaks, earlier in his letter, of very piercing N.N.E. winds. If that very piercing N.N.E. wind sprang up after sunrise, my theory is confirmed. The stillness at 3.20 a.m. would aid deposition of hoar frost, which would be melted by the sun, and then the wind would cause rapid evaporation. If, however, no wind sprang up, my theory is gone as far as he is concerned. Would it not be interesting to ask him?

Regarding the height at which the damage here took place, the most damage was done in the valley between here and Croydon, say about 150 to 200 ft. above sea level, exposed to N.N.E. and N.N.W. There the ashes were blackened, oaks and maples shrivelled; at Ingleside, 375 feet above sea, the ashes were no worse, but yew trees nipped, and the damage was comparatively slight. Higher on the hill, say to the top (500 feet), the result was about the same as at Ingleside. Ingleside hillside faces N.E.—Yours sincerely,

HAROLD SMITH.

Ingleside, Kenley, Surrey, July 25th, 1894.

To the Editor of the Meteorological Magazine.

SIR,—I have no desire to impugn anything that Mr. Harold Smith says in his letter published in the July Magazine touching the May frost and the N.E. wind.

I fully admit that the N.N.E. wind, which set in on the 15th, and suddenly became so bitter about noon May 19th, *brought* the cold; but I maintain that, in Northamptonshire at least, it was the dropping of the wind that made that cold so powerful for mischief. It was precisely that dropping of the wind which made me on the Sunday evening foresee, and make preparations for, the frost; and of the intense stillness of the air at 3.20 a.m. on May 21st there can be no doubt.

You attributed the mischief mainly to radiation; and for this county your remarks are strongly corroborated by the reports which have reached me from many members of the Northamptonshire Natural History Society (Meteorological Branch).

The mischief done by the frost has only gradually been revealed. I had hoped that my apples and pears, of which I had an extraordinarily abundant crop, and which seemed well *set*, would have survived, but they have been dropping off by slow degrees ever since, until most trees have none left, and the rest but very few. Many

gooseberries dropped at once, but more were left than I at first supposed. Currants at first seemed less hurt, and have nearly all disappeared since.

Wasps were very numerous on the first days of June, but I have hardly seen any for the last four weeks; and now I am wondering whether they will presently be appearing in swarms proportionate to their numbers in the early spring.

H. A. BOYS.

Easton Mauduit Vicarage, Northampton, July 23rd, 1894.

P.S.—A saying has been reported to me from N.W. Essex: "As many misties in March, so many frosties in May;"—too well borne out this year!

To the Editor of the Meteorological Magazine.

SIR,—I see that in the July *Met. Mag.* you notice Mr. H. Clements' forecast for July. He was singularly wrong for this district, the rainfall here being 5·02 in., against an average of 2·72 in. for 19 years.

Anent Mr. Harold Smith and your remarks on the May frost, here a young plantation, facing north, had nearly every tree damaged, whereas another, facing south, had scarcely one injured. This seems to support Mr. H. Smith's view. The frost was—20th, 29° in Stevenson screen and 25° on ground; and 21st, 29° and 25° respectively.—Yours truly,

EDWARD SIMPSON.

Walton Hall, Wakefield, August 1st, 1894.

THE BRITISH ASSOCIATION AT OXFORD.

A generation has passed since the British Association has visited that grand old city, which may in some respects claim to be the ancestral home of British science—the home of Boyle, Wallis, Hooke—and for a time, in its early days, of the Royal Society.

Old and grand as are the traditions of Oxford, what has struck us most is the growth since 1860—then the new museum was just being filled by Professor Phillips, and it stood almost in the fields, now it is in the city—Keeble College was not thought of—nor was there, we believe, one of the excellent ladies' colleges—now we find telephones, tramways, electric lightning—in fact Oxford, while retaining all its old charm, is at the same time seizing all the good things, and showing a vigour which centuries do not seem to check.

The Association meeting has been a large and very pleasant one, considerably larger than that of 1860.

We give notes of some of the meteorological papers, and hope to complete the series in our next.

EARTH TREMORS COMMITTEE.

Abstract of Report drawn up by the Secretary, MR. C. DAVISON.

Since the last Report was written, several changes have been made by Mr. H. Darwin in his bifilar pendulum. (1) The mirror is mounted in a light frame so that its plane is perpendicular to that of the suspending wire, thus diminishing the disturbing effects of changes of temperature. (2) The lever used for tilting the frame of the pendulum through a known angle is constructed so that its centre of gravity coincides with the axis of the tilting-screw. (3) Without approaching the instrument the spot of light can be adjusted to the centre of the scale or photographic paper, and the sensitiveness altered, by means of tangent-screws connected with the foot-screws and worked by long handles.

The Greek earthquake pulsations of April 27th were observed in Birmingham with the bifilar pendulum from 7.59 to 8.28 p.m. (G.M.T.) Their average period was from 12 to 14 seconds, and their range in the E.-W. plane not less than ¼" when greatest. The pulsations of April 20 and 27 were recorded by tromometers at several geodynamic observatories in Italy, by horizontal pendulums at Nicolaiew and Charkow in the south of Russia, and by magnetographs at Potsdam, Wilhelmshaven, Parc St. Maur, Utrecht and Kew. The Brassart seismoscopes at the observatory of Athens enable the time at the epicentrum to be determined fairly accurately. Making use of the epochs at which the first large pulsations are registered, the following are the estimates of the mean velocity :

April 20.—2·08 km. per sec. [78 miles per min.] (from 6 observations).

April 27.—3·21 km. per sec. [120 ,, ,,] (from 13 observations).*

One of the improved bifilar pendulums with photographic recording apparatus will shortly be erected at Birmingham. The Committee consider it desirable that its records should be compared for about a year with those of a similar instrument placed a short distance from it. They accordingly ask to be re-appointed so as to continue their work, and to be provided with a grant of £100 for the purchase and installation of a duplicate apparatus.

[*The Japan earthquake of March 22nd, 1894, was recorded at Rome, and in *Nature* of August 9th the velocity of propagation is taken as 2·50 km. per second, or 93 miles per minute.—ED.]

UNDERGROUND TEMPERATURE COMMITTEE.

TWENTIETH REPORT.

Report drawn up by PROF. EVERETT, *Secretary.*

The Committee were re-appointed for the purpose of investigating the rate of increase of underground temperature downwards in various localities of dry land and under water.

The nineteenth report contained the results of observations taken in 1891 by Mr. Hallock, of the Smithsonian Institution, at depths extending to 4,462 ft. in a nearly dry well at Wheeling, Virginia.

Mr. Hallock, who now dates from Columbia College, New York, has recently furnished the Secretary with printed copies of a paper, contributed by him to the American Association for the Advancement of Science last year, containing further observations in the well, made at the expense of the U.S. Geological Survey.

When the observations of 1891 were finished, an oak plug was driven into the top of the casing to protect the hole. In July, 1893, the plug was with-

drawn, and the well, instead of being dry as before, was found to be full of fresh water to within 40 ft. of the top. This water is believed to have leaked in at the lower end of the innermost casing—that is, at 1,570 feet below the surface.

By means of inverted Negretti maximum thermometers, protected against pressure by sealing them in stout glass tubes, careful observations were taken at various depths from 1,586 ft. to 3,196 ft., two thermometers being employed to check one another at each depth. The results were practically identical with those obtained two years previously, when the well was full of air, the greatest certain difference being only one-fifth of a degree. An obstruction at 3,200 ft. prevented observation at greater depths; but this obstruction will probably be removed, the well pumped dry, and the drilling continued.

In making the observations, four thermometers were lowered at a time, two of them being in an iron bucket 3 feet long and 3 inches in diameter at the end of the wire, and the other two in an open wire frame 260 ft. from the end of the wire, the diameter of the bore being just under 5 inches.

The temperatures at 103 ft., 206 ft., and 300 ft. were also observed with suitable thermometers, the temperature at 103 ft. being 52°·53, which is 1°·2 higher than the true temperature of the soil at that depth, as determined by other observations in the immediate neighbourhood.

The smallness of the disturbance of temperature by convective circulation in this well, both when dry and when filled with water, is very remarkable, and renders the well specially suitable for determinations of the increase of temperature downwards.

The Committee have to record with deep regret the loss of their valuable member, Mr. Pengelly.

REVIEW.

Aero-therapeutics, or the treatment of Lung Diseases by Climate . . . with an address on the High Altitudes of Colorado, by CHARLES THEODORE WILLIAMS, M.D.Oxon., Senior Phys. to the Consumption Hospital, late President Royal Meteor. Soc. 8vo. Macmillan: London, 1894. 188 pages.

THIS volume contains the Lumleian Lectures for 1893, delivered by the author before the Royal College of Physicians, with its esteemed President, the late Sir Andrew Clark, Bart., M.D., in the chair.

Dr. Theodore Williams in his brief preface says:—

> "I have attempted in the following pages to sketch a scientific system of Aero-therapeutics, based on the combination of modern meteorology with clinical experience, each element of climate being duly considered in its bearing on Health and Disease.
>
> "Unfortunately our knowledge in these departments contains many gaps, which increasing experience may, it is to be hoped, gradually fill in."

In our opinion, Dr. Williams has produced a work which goes far beyond the above limits, and we have not noticed one point in which he appears to us to have laid himself open to attack. In fact, it would have been strange if he had, because he possesses several

special qualifications for writing upon the subject. (1) We do not see anything wrong in his meteorology.* (2) Dr. Theodore Williams is thoroughly devoted to his profession, and has travelled largely so as to be personally familiar with the districts to which he sends his patients. (3) He is evidently most careful in keeping, and in working up, statistics as to his patients; in fact, while rigorously securing the anonymity of his patients, the way in which he combines the doctor and the statistician is excellent. As a specimen, we reproduce one of his tables dealing with 814 cases:—

TABLE IV.—*Results of Different Climates compared.*

	No. of Patients.	Average length of Residence.	First Stage.	Second and Third Stages.	Bilateral Affection.	RESULTS.						
						GENERAL.			LOCAL.			
						Improved.	Stationary.	Worse.	Arrest.	Improved (including Arrest).	Stationary.	Worse.
		Months.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
High altitudes.	247	12·2	65·0	35·0	37·0	83·4	2·0	14·6	42·5	75·5	5·3	19·1
Sea voyages ...	65	1·6 average of voyage	63·0	37·0	37·0	77·0	—	21·6	7·7	53·3	10·7	33·8
Riviera	210	9·0	59·0	41·0	36·0	65·2	10·0	24·8	5·9	36·6	17·8	45·6
Home climates.	292	9·7	58·0	42·0	42·0	63·7	8·2	28·0	2·0	38·9	20·0	41·1

We see no advantage in the second decimal in columns 8 and 9 in the original, and have, therefore, omitted them; and in the "Results" for the second line—sea voyages—there is 1·4 per cent. lost somewhere in the "General" columns, and 2·2 per cent. in the "Local" columns.

Our meteorological readers must not, however, assume that the work is wholly medical; on the contrary, it may be regarded as consisting of three ingredients in nearly equal proportions, meteorology, medicine, statistics.

It is not usual to set up part of the index of a book in a review but we know of no plan which will give in smaller space an equally

* Except quite unimportant little things, such as printing 47·5° for 47°·5, and quoting, on page 38, the humidity at Cairo to two places of decimals, 58·46. Doubtless it was so given in the work whence Dr. Williams quoted it; but the second decimal place of humidity is about the equivalent of the third decimal place of temperature, and few would trust a wet-bulb thermometer to the thousandth of a degree. We therefore gibbet the error. Dr. Williams is responsible merely for copying a bad example without thinking of its absurdity,

good indication of the variety of information which the book contains :—

	PAGE
Eden, Australia	69
Egger, Dr.	111
Egypt, Climate of	37
,, Statistics of Patients sent to	39
Electricity, Atmospheric ...	2, 178
,, Phenomena on Pike's Peak ...	161
Elevations, Four series of, in Colorado	153
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Ewart, Dr. W.	127

ÆRIAL, AERIAL OR AËRIAL.

To the Editor of the Meteorological Magazine.

SIR,—I am disposed to question the propriety of two cases of typography in the *Meteorological Magazine* for July, page 89. In lines 25 and 26 you print "Ærial," and in line 34 "ærial;" it seems to me that these should be "Aerial" and "aerial," just as in line 17 you print Aerodynamics. "Ærial" reminds me somewhat of what people call "areated" instead of "aerated" bread. Excuse my hypercriticism, and believe me, yours very faithfully,

J. M. DU PORT.

Denver Rectory, Downham, July 31st, 1894.

[We felt very penitent on reading the above, and also on turning up "Aerial" in Nuttall's Dictionary; but, before pleading guilty, wrote to ask Mr. Washington Moon. He replied "Æ is not justifiable in Aërial, which is the only word we have beginning with *aer* in which the accent is on the second vowel, therefore do not omit the diæresis; Aerial is as wrong as is Ærial. Probably the pronunciation of *aer* in *aërial* was differentiated from that of other words which begin with *aer* in order to distinguish aerial from the sound of the proper name *Ariel*." Thus far, therefore, the Canon and the Editor and the Dictionary are alike condemned.

Finally, we turned to Nuttall itself for the definition of the word Diæresis, and found "the mark (··) placed over two vowels, denoting that they are to be pronounced as distinct letters, as *aër*."

In the first place, this statement says "over *two* vowels," and as an illustration puts the mark over *one* / and in the second place, while on p. 272 it quotes *aër* as a type of what should be done, on p. 21 it gives—

Orthography.	Pronunciation.
AERATE	*ā-ĕr-ate.*
AERATION	*a-ĕr-ā-shun.*
AERIAL	*a-ē-re-al.*
AERIFEROUS	*ayr-if-er-us.*
AERIFIED	*ayr-e-fide.*
AERONAUT.....	*ayr-o-nawt.*

The diæresis is not omitted because the printer had no capital E with the diæresis, for in the definitions they are similarly omitted; evidently Dr. Nuttall forgot them.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1894.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	56·4	7	23·3	19	47·8	35·5	36·6	83	91·1	18·0	1·75	16	5·8
Malta	64·8	28	42·8	16	58·7	49·9	47·1	82	117·5	37·4	4·40	8	6·5
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	85·5	20	69·6	1	83·1	74·0	70·1	78	138·1	62·2	4·48	18	6·0
Calcutta	91·5	17	54·1	6	84·0	62·0	61·2	70	143·9	44·6	·25	1	1·4
Bombay	88·6	15	64·6	3	84·0	70·9	66·7	70	137·5	55·4	·00	0	0·4
Ceylon, Colombo	91·8	14	68·0	1	88·7	72·0	69·8	75	147·0	61·0	·52	6	1·8
Melbourne	96·1	5	46·2	13	77·6	56·3	51·7	62	146·1	36·1	·39	4	4·5
Adelaide	101·3	4	49·8	19	82·6	58·3	50·0	48	158·3	42·5	·01	1	2·5
Sydney	83·3	21	58·8	14*a*	75·5	64·4	58·3	75	153·9	50·1	5·06	18	5·5
Wellington	80·0	23	48·0	26	71·0	57·6	53·8	69	140·0	35·0	5·22	12	4·5
Auckland	81·5	9	49·0	27	74·8	61·3	60·6	77	147·0	47·0	3·65	11	5·3
Jamaica, Kingston	89·0	7	62·8	5	84·0	66·2	65·4	79	...	...	·67	8	2·9
Trinidad	95·0	2	63·0	8, 9*b*	86·6	65·6	67·1	76	167·0	61·0	2·36	12	...
Toronto	43·1	28	— 9·9	24	28·0	12·4	18·4	81	...	—10 0	2·25	14	6·0
New Brunswick, Fredericton	44·9	18	—30·5	14	24·0	— 2·7	8·0	77	...	...	2·95	9	4·0
Manitoba, Winnipeg	37·6	28	—30·7	19	15·2	— 9·9	...	...	...	...	1·00	6	5·0
British Columbia, Esquimalt	51·9	26	20·2	19	41·6	32·3	34·6	90	...	...	4·27	22	8·0

a And 23. *b* And 10.

REMARKS.

MALTA.—Mean hourly velocity of wind 14·6 miles, the highest recorded in 11 years; for the 5 days 19th to 23rd the velocity averaged 30 miles per hour. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·4 below, dew point equal to, and rainfall 1·73 in. below, their respective averages. Mean hourly velocity of wind 13·3 miles, or 2·0 miles above average; extremes, 62·2 on 22nd, and 0·0 on 27th and 28th; prevailing direction, E.S.E. T and L on 7th, 8th, and 9th, T on 18th, and L on 21st. A cyclone passed N.E., E. and S.E. of the island between the 19th and 24th. C. MELDRUM, F.R.S.

Melbourne.—Aurora Australis visible from 7.30 to 10.30 on the 25th. T and L on 27th and 28th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 3°·3 below the average of 37 years, the month being, with one exception, the coolest February experienced since records began. Rainfall very light, ·62 in. below the average. C. TODD, F.R.S.

Sydney.—Weather dry in the first part of the month, wet in the latter part; generally hot and oppressive. H. C. RUSSELL, F.R.S.

Wellington.—Showery in the early part of the month, and strong N.W. wind on 2nd, 3rd, and 12th; fine during the middle, with light variable winds; the end of the month very wet, with strong winds from S.E., 2·90 in. of rain falling on the 25th and 26th. Prevailing winds N.W. Sleet fell on 25th and 26th. Mean temp. 1°·3, and rainfall 1·68 in. above, the average. R. B. GORE.

Auckland.—A heavy fall of rain occurred on the 16th, 1·95 in. being recorded, but no other noteworthy peculiarities. Barometrical pressure, mean temp., and rainfall all close to the average of 27 years. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 4·0 miles. Weather fine, with average rainfall. On the 5th the barometer reached the highest point since the establishment *of the service in 1880*, viz., 30·180 in. (cor. and red.) at 7 a.m. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	5·66	XI.	Rhayader, Nantgwillt..	6·73
,,	Birchington, Thor	3·95	,,	Lake Vyrnwy	3·14
,,	Hailsham	6·12	,,	Corwen, Rhug	1·90
,,	Ryde, Thornbrough	5·26	,,	Carnarvon, Cocksidia ...	3·48
,,	Emsworth, Redlands ...	5·14	,,	I. of Man, Douglas	2·46
,,	Alton, Ashdell.....	5·36	XII.	Stoneykirk, Ardwell Ho.	2·12
III.	Oxford, Magdalen Col...	3·36	,,	New Galloway, Glenlee	2·97
,,	Banbury, Bloxham	3·23	,,	Melrose, Abbey Gate ...	2·25
,,	Northampton, Sedgebrook	2·89	XIII.	N. Esk Res. [Penicuick]	2·15
,,	Alconbury.....	2·49	,,	Edinburgh, Blacket Pl..	2·83
,,	Wisbech, Bank House..	3·55	XIV.	Glasgow, Queen's Park.	2·71
IV.	Southend	4·00	XV.	Inverary, Newtown	5·79
,,	Harlow, Sheering	3·10	,,	Islay, Gruinart School..	1·39
,,	Colchester, Lexden.....	3·96	XVI.	Dollar.....	2·96
,,	Rendlesham Hall	2·05	,,	Balquhidder, Stronvar..	5·78
,,	Diss	4·08	,,	Ballinluig	2·64
,,	Swaffham	2·67	,,	Dalnaspidal H.R.S. ...	4·81
V.	Salisbury, Alderbury...	3·49	XVII.	Keith H.R.S.	7·62
,,	Bishop's Cannings	4·38	,,	Forres H.R.S.	5·41
,,	Blandford, Whatcombe.	4·93	XVIII.	Fearn, Lower Pitkerrie.	4·78
,,	Ashburton, Holne Vic....	6·09	,,	Loch Shiel, Glenaladale	6·55
,,	Okehampton, Oaklands.	3·70	,,	N. Uist. Loch Maddy ...	4·77
,,	Hartland Abbey	4·39	,,	Invergarry	3·11
,,	Lynmouth, Glenthorne.	4·59	,,	Aviemore H.R.S.	2·96
,,	Probus, Lamellyn	4·55	,,	Loch Ness, Drumnadrochit	3·29
,,	Wellington, Sunnyside..	4·05	XIX.	Invershin	4·82
,,	Wincanton, Stowell Rec.	5·64	,,	Scourie	5·29
VI.	Clifton, Pembroke Road	5·35	,,	Watten H.R.S.	4·07
,,	Ross, The Graig	2·60	XX.	Dunmanway, Coolkelure	4·20
,,	Wem, Clive Vicarage ...	2·63	,,	Fermoy, Gas Works ...	5·26
,,	Cheadle, The Heath Ho.	2·48	,,	Killarney, Woodlawn ...	5·22
,,	Worcester, Diglis Lock	2·58	,,	Tipperary, Henry Street	4·19
,,	Coventry, Coundon	2·93	,,	Limerick, Kilcornan ...	4·54
VII.	Ketton Hall [Stamford]	3·03	,,	Ennis	4·05
,,	Grantham, Stainby	3·16	,,	Miltown Malbay.....	5·66
,,	Horncastle, Bucknall ...	2·94	XXI.	Gorey, Courtown House	3·93
,,	Worksop, Hodsck Priory	2·70	,,	Athlone, Twyford	3·61
VIII.	Neston, Hinderton	2·79	,,	Mullingar, Belvedere ...	3·44
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	4·56
,,	Broughton-in-Furness..	5·23	XXII.	Galway, Queen's Coll...	5·79
IX.	Ripon, Mickley	3·32	,,	Crossmolina, Enniscoe..	...
,,	Scarborough, South Cliff	2·57	,,	Collooney, Markree Obs.	5·87
,,	East Layton [Darlington]	2·52	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	2·98	XXIII.	Lough Sheelin, Arley ..	4·65
X.	Haltwhistle, Unthank..	2·74	,,	Warrenpoint	3·85
,,	Bamburgh.....	1·33	,,	Seaforde	4·16
,,	Keswick, The Beeches...	3·75	,,	Belfast, Springfield	5·20
XI.	Llanfrechfa Grange	4·82	,,	Bushmills, Dundarave...	3·75
,,	Llandovery	4·24	,,	Stewartstown	3·38
,,	Castle Malgwyn	4·69	,,	Buncrana	4·06
,,	Builth, Abergwessin Vic.	6·50	,,	Lough Swilly, Carrablagh	4·48

and heat to ripen them. With the exception of the high temp. on the 2nd, the ther. rose to 70° or upwards on 11 days only. Wind mostly from W. and S.W., and S.E. Many days were damp, warm and relaxing.

GOGERDDAN.—Stormy throughout the month, with very little bright sunshine.

SCOTLAND.

CARGEN.—The temp. during the first 25 days of the month, with the exception of the first two days, was somewhat cold and ungenial, but from the 25th to the end was very warm, the mean temp. of the month being about the average. Westerly winds prevailed for 20 days. A severe TS, lasting an unusually long time, was experienced on the 6th, and T was heard on the 19th. A remarkable solar halo was seen on the 11th. All crops abundant and looking well. The hay crop much above the average.

JEDBURGH.—The R in the first half of the month was frequent, but generally the weather was agreeable, and as there was much sunshine, all crops look well. Corn cutting will be a month later than last year. The atmosphere was very still after the 15th. T, L and heavy R on the 9th and 15th.

MULL QUINISH.—Generally a warm, wet month; great heat from 1st to 4th, and from 24th to 31st; all crops and vegetation most luxuriant.

BRAEMAR.—A month of fine, settled weather; sunshine 162 hours; sharp TS, with vivid L, from 9 p.m. to 11 p.m. on the 6th; T and L from 3 to 6 p.m. on the 21st.

ROEBERRY.—The wettest July recorded in 27 years, the R being 2·19in. above the average of that period. Mean temp. 57°·3.

IRELAND.

DARRYNANE ABBEY.—A wet, bad month. Very heavy R all the morning on 31st, 1·19 in. falling in rather under 8 hours. Potato blight much spread and increasing fast.

WATERFORD, BROOK LODGE.—A wet month, with a good deal of T. The max. temp. very regular at about 65°. Blight commenced to show in the potatoes, and very little hay was got in from the fields. Green crops look well. T on 1st, T, L and H on 7th, L on 10th, heavy T with H on 23rd.

O'BRIENSBRIDGE, ROSS.—The worst possible month for hay-making, causing heavy loss in all the early cuttings. T and L frequent, and a cow killed by L on 23rd.

DUBLIN.—A very changeable, showery and thundery, but tolerably warm month, of average mean temp., but considerable R, with a decided prevalence of winds from westerly points, but easterly towards the close. Mean temp. (60°·3) slightly below the average. Rainy days 4 above the average. High winds on 7 days, attaining the force of a gale on the 18th. Electrical disturbances were frequent, and a severe TS occurred on the night of the 25th. A parhelion appeared on the evening of the 25th. [The mean temp. for June should have been 43°·1, not 49°·0.]

EDENFEL.—There can be no better example of how mere figures without explanation may mislead as to the character of weather than in contrasting the returns for July, 1893 and July, 1894. The former, with a R of 3·64 in., was a fine, fresh, mostly dry and sunshiny month, and one of the most favourable hay harvests for many years, while the month just passed, with a R of but 3·08 in., has been (with but a short interval) in all respects the reverse. A cloudy, saturated atmosphere, with Scotch-misty "dropping" weather, rendered hay-saving the most difficult and prolonged in 30 years, and fruit of all kinds almost flavourless.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

BRITISH RAINFALL.

Subscriptions of £1 and upwards or payments for publications to that amount received to September 12th, 1894 :—

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THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy.)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

All communications should be addressed to the Editors of "The Observatory," Royal Observatory, Greenwich, S.E.

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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXLIV.] SEPTEMBER, 1894. [PRICE FOURPENCE, *or 5s. per ann. post free.*

THE BRITISH ASSOCIATION.

WE reported some of the proceedings in our last, and now complete our notice. The following were, we believe, the only papers bearing upon Meteorology :—

A.—Report of Committee on Meteorological Photography (1).
A.—Report of Committee on Solar Radiation (2).
A.—Report of Committee on Underground Temperature (3).
A.—Report of Committee on the Ben Nevis Observatory (4).
A.—Dr. A. BUCHAN.—On the Scottish Rainfall (5).
A.—J. PARK HARRISON.—On Lunar Curves of Mean Temperature at Greenwich : and the Heat of the Moon (6).
B.—Dr. S. RIDEAL.—Iodine Value of Sun-light in the High Alps (7).
B.—Report on Earth Tremors (8).
C.—Report of the Committee on Underground Waters (9).
C.—Report of the Committee on the Volcanic Phenomena of Vesuvius (10).
E.—Address of President (11).
E.—Report on the Climatology of Tropical Africa (12).
E.—Report of the Committee on Antarctic Exploration (13).
H.—OSBERT H. HOWARTH, C.E., F.R.G.S.—Life at High Altitudes in the Great West (14).

We have prefixed the letter of the Section before which each report or paper was read ; it does not say much for organization that they should have been distributed among five Sections. Numbers 3 and 8 were given in our last ; Number 5 did not arrive ; of Numbers 6, 7, 10, and 14 we have not been able to obtain particulars. All the others are noticed below :—

Fourth Report on the Application of Photography to the Elucidation of Meteorological Phenomena. Drawn up by the Secretary, MR. A. W. CLAYDEN.

In presenting their report on the work of the last year, your committee have but little to say on the subject of the representation of clouds and lightning by photography. They consider that their collection is nearly complete as far as the different varieties of cloud form are concerned, and it is only likely to be increased slowly and at long intervals by photographs of scarce forms of clouds or by particularly interesting series. During the year, the Secretary has secured many new negatives, but since the collection already includes satis-

factory examples of the same types, it has not been thought desirable to add more duplicates, and the offers of co-operation from other photographers have not been fulfilled.

With regard to photographs of lightning also, the collection has not been increased, for your committee have not been made aware of any photographs which show any features not already familiar, and no opportunity has occurred for the Secretary to make any observations for the further elucidation of the known phenomena.

Your committee propose to invite the Royal Meteorological Society to take charge of such photographs from their collection as are not likely to be required for further investigation.

The attention of the committee has been drawn to another application of photography which seems to open up a possibility of very valuable work. This is in the measurement of cloud altitudes.

This is a question which has become more important since the acceptance by the Munich Congress of the system of cloud nomenclature devised by Hildebrandsson and Abercromby, and it is remarkable that few actual measurements have been carried out.

As far as your committee are aware, the only measurements of the kind which have been systematically organised in this country are those which were begun some years ago at Kew.

It is not only important to have more observations, but it is specially desirable to have them from other places than the vicinity of London for comparison, and in the residence of the Secretary, at Exeter, such an opportunity is presented.

In the course of experiments on methods of cloud photography, it has been found easy to secure well-defined images of clouds, even when the sun is in the middle of the field of view. If then two such photographs are taken simultaneously by a pair of cameras at some distance apart, there will be a displacement of the image relatively to that of the sun. The amount of this displacement will depend upon a number of things, but it will be increased by adding to the focal length of the lens, and by increasing the distance between the cameras. By knowing these values, and the altitude and azimuth of the sun, the distance of the cloud and its height above the ground may be calculated without difficulty.

The azimuth and altitude of the sun at the time of exposure may be ascertained by direct observation, or it may be found by calculation from the known time at which exposure was made. There seems to be a manifest advantage in thus using the sun as a fixed point of reference, and it provides a means whereby any error in the observation of altitude and azimuth may be effectively checked.

Your committee have therefore prepared a pair of cameras so constructed that they may be easily directed towards the sun. They are provided with lenses of 18 inches focus, covering a plate of whole-plate size, thereby giving a large displacement, and allowing room for a displacement of several inches. The lenses are provided with adjustable shutters which can be simultaneously freed by an electrical attachment. They are placed on stands which serve as cupboards for them when not in use.

At present for purely trial purposes they are placed in the Secretary's garden at a distance of thirty-five yards, yet even that short distance gives a displace-

ment of half an inch with clouds 3,780 feet distant. This, of course, is too small for very accurate measurement, and would be far smaller with high level clouds, the determination of the altitudes of which is most important.

The intention of your committee is to place them on a plot of level ground by the side of the London and South-Western Railway near Exeter. There is available a strip of waste ground just over a quarter of a mile in length, commanding an uninterrupted view of the sun from sunrise until nearly sunset. The ground is level, and the cameras can be placed due east and west, thereby greatly simplifying the reduction of the observations.

The directors of the London and South-Western Railway have kindly consented to allow the ground to be used under conditions which seem to your committee quite satisfactory, but which involve the payment of a nominal rent of £1 per annum. The cameras would have been placed in position by the present time had it not been necessary to get another meeting of the committee to sanction the agreement.

The method is easy to apply, and promises to yield results at least as accurate as any which have yet been tried; therefore your committee ask for re-appointment, with a grant of £10.

———

Dr. Hugh R. Mill gave the results of a bathymetrical survey of the English lakes. Ten of the largest English lakes were sounded by the author, assisted by Mr. E. Heawood, Mr. Shields, and others, and the final discussion of the work enabled a tabular statement to be drawn up, which showed the following and other details:—

Name.	Length, miles.	Depth, feet.		Volume, million cubic feet.
		Max.	Average.	
Windermere	10·50	219	78½	12,250
Ullswater	7·35	205	83	7,870
Wastwater	3·00	258	134⅓	4,128
Coniston	5·41	184	79	4,000
Crummock	2·50	144	87½	2,343
Ennerdale	2·40	148	62	1,978
Bassenthwaite	3·83	70	18	1,023
Derwentwater	2·87	72	18	1,010
Haweswater	2·33	103	39⅓	589
Buttermere	1·26	94	54½	537

There are two main types amongst these lakes, the shallow and the deep. The former including only Derwentwater and Bassenthwaite, are the broadest of all the lakes, and they average only 18 ft. in depth. The bed of these lakes may be roughly described as an undulating plain, grooved and ridged into shallow hollows, and low shoals running parallel to the long axis of the lake. The second, or deep type, the shallowest of which has an average depth of 40 ft., comprises all the other lakes. Ennerdale combines the characteristics of both types, conforming to the deep type in its upper, to the shallow in its lower, reach. They are long, narrow, sometimes winding like Ullswater, or slightly curved in outline like Wastwater and Haweswater. The most characteristic lie in long, narrow valleys with steeply sloping sides, and the slopes are con-

tinued under water with almost equal steepness—in some cases with greater steepness—and terminate in an almost flat floor. The typical form of this class of lake is thus a steep-sided flat-bottomed trough, diversified along the slopes by the still steeper conical mounds of *débris* thrown down at the mouths of streams.

Third Report of a Committee on the Climatological and Hydrographical Conditions of Tropical Africa. Drawn up by MR. E. G. RAVENSTEIN.

YOUR Committee, up to the end of July last, had issued five sets of meteorological instruments at a cost, including forms, carriage, &c., exceeding £100. The first of these sets was entrusted to Mr. J. W. Moir (British Central Africa), the second to Mr. Buchanan (British Central Africa), the third to Captain Gallwey (Warri, Benin), the fourth to the Rev. C. Bonzon (Lambarene, on the Ogowe), and the fifth to the Rev. R. Glennie (Bolobo, Congo). A sixth set is kept in reserve for British East Africa.

Two of these sets, namely, those in the hands of Mr. Buchanan and Mr. Glennie, include Fortin barometers, whilst that granted to Captain Gallwey includes a black bulb thermometer.

Observations up to the latest possible date have been received from Mr. Glennie, Mr. Bonzon, and Dr. Roth, as representing Captain Gallwey.

Instructions have been issued to the officials of the Royal Niger Company to make their observations in future in accordance with the rules laid down by your Committee, and the like step is contemplated by the British East Africa Company.

Summaries of meteorological returns are appended to this report. Your Committee are quite aware that these observations are not in every instance as complete and trustworthy as could be desired. In some cases the hours of observation are ill chosen (a very common occurrence), in others the instruments are defective, or the corrections to be applied to the readings are unknown. If they are published notwithstanding it is done because they refer to localities concerning which nothing or very little is known at the present time.

Quite a number of meteorological records offered to the Committee for publication have had to be rejected as being on the face of them utterly untrustworthy. It seems a pity that so much time and labour should have been wasted upon recording observations which, with a little forethought and caution, might have furnished important information on the climate of Tropical Africa.

The grant of £5 made to the Committee last year was not claimed.

[From the tables appended to this report we have prepared the following abstract.—ED. *M.M.*]

ABSTRACT OF METEOROLOGICAL OBSERVATIONS IN AFRICA.

Name of Station ...	Bolobo	Warri	Kips Hill	Namirembe	Fort Salisbury	Ribe	Mochi	Sagala
Territory	Congo	Benim	Niger	Uganda			Kilimanjaro	Taita
Latitude	2° 10′ S.	5° 31′ N.	8° 48′ N.	0° 18′ N.	17° 50′ S.	3° 55′ S.	3° 18′ S.	3° 32′ S.
Longitude	16° 13′ E.	5° 51′ E.	6° 25′ E.	32° 34′ E.	31° 4′ E.	39° 40′ E.	37° 23′ E.	38° 35′ E.
Altitude.....	1080 ft.	10 ft.	—	4000 ft.	5050 ft.	500 ft.	5000 ft.	3300 ft.
Observer	Rev. R. Glennie	Capt. Gallwey	Rev. C. Paul	Rev. E. Millar	Major Forbes	Rev. T. Wakefield	Rev W Morris	Rev J A Wray
Period of Observtn.	1891–3	1891–3	1881	1893-4	1891–2	1876–77	—	—
Bar. at 32° { Time of Obs.	7, 2, 9	—	—	—	—	9, 9	—	—
Bar. at 32° { Mean pressure	28·813	—	—	—	25·398	29·492	—	—
Temperature { Time of Obs.	7, 2, 9	—	9, 9	—	—	6, 3, 9	—	—
Temperature { Mean	77°·5	80·1	81	67·2	66·2	78 8	65	72
Temperature { Mean Max.	85·9	85·8	—	76·9	78·9	? 83	73	83
Temperature { Mean Min.	70·7	74·4	—	57·4	53·5	? 76	57	61
Temperature { Absolute Max.	96·6	99·0	96	85·8	93	92	82	96
Temperature { Absolute Min.	55·0	68·0	74	52·1	34	69	50	54
Temperature { Mean Range	15·2	11·4	—	19·5	25·4	? 7	16	22
Temperature { Absolute Range	41·6	31·0	22	33·7	59	23	32	42
Rain per year*	56 in.	150 in.	—	35 in.	34 in.	51 in.	—	—
Prevalent Wind ...	—	—	—	—	E.N.E.	E.S.E.	—	—

* Computed and only a rough approximation.

Address to the Geographical Section, by CAPTAIN W. J. L. WHARTON, R.N., F.R.S., *Hydrographer to the Admiralty, President of the Section.*

THIS address dealt exclusively with features analogous to those treated by Maury in his "Physical Geography of the Sea." We can reprint only some of the principal facts.

After long hesitation and much argument, I think that it may now be safely held that the prime motor of the surface currents of the ocean is the wind. Not, by any means, the wind that may blow, and even persistently blow, over the portion of water that is moving, more or less rapidly, in any direction, but the great winds which blow generally from the same general quarter over vast areas. These, combined with deflection from the land, settle the main surface circulation.

I do not know if any of my hearers may have seen a very remarkable model devised by Mr. Clayden, in which water disposed over an area shaped like the Atlantic, and sprinkled over with lycopodium dust to make movement apparent, was subjected to air impelled from various nozzles, representing the mean directions of the permanent winds. It dispelled the last doubt I held on the subject, as not only were the main currents reproduced, but the smaller effects and peculiarities of the Atlantic drifts were produced with surprising accuracy.

There is a small current, long shown on our charts, but which I had always regarded with suspicion. I refer to the stream which, after travelling from the Arctic Ocean southward along the east coast of Greenland, turns sharply round Cape Farewell to the northward into Davis Straits, where it again doubles sharply on itself to the southward. This is exhibited, in the model, in all its details, and is evidently caused by the pressure of the water forced by the mimic Gulf Stream into the Arctic region, where it has no escape except by this route, and is pressed against the land, round which it turns as soon as it can. This is, no doubt, the explanation of the real current.

One instance of the underrunning of one current by another is brought very plainly to our notice in the North Atlantic, to the east of the Great Banks of Newfoundland, where the icebergs borne by the arctic current from Baffin Bay pursue their course to the southward across the Gulf Stream running eastward.

These great masses of ice, floating with seven-eighths of their volume under the surface, draw so much water that they are all but wholly influenced by the under-current. A large berg will have its bottom as much as six or seven hundred feet below the surface. The only reason that these bergs continue their journey southward is the action of the cold under-current.

Our knowledge of the depth of the ocean is steadily, though slowly increasing. The whole of it has been gained during the last fifty years.

Commenced by Sir James Ross, whose means were very small, but who nevertheless demonstrated that the so-called unfathomable ocean was certainly fathomable everywhere, the sounding of the ocean has continuously proceeded. The needs of submarine cables have constantly demanded knowledge in this particular, and the different cable companies have had a large share in ascertaining the facts.

It is hopeless to do more than to briefly sketch the amount of our knowledge.

First, as to the greatest depths known. It is very remarkable, and from a geological point of view significant, that the very deepest parts of the ocean *are not in or near* their centres, but in all cases are very near land.

One hundred and ten miles outside the Kurile Islands, which stretch from the northern point of Japan to the north-east, the deepest sounding has been obtained of 4,655 fathoms, or 27,930 feet (5⅓ miles). This appears to be in a deep depression, which runs parallel to the Kurile Islands and Japan; but its extent is unknown, and may be very large.

Seventy miles north of Porto Rico, in the West Indies, is the next deepest cast known, viz., 4,561 fathoms, or 27,366 feet (5¼ miles); not far inferior to the Pacific depth, but here the deep area must be comparatively small, as shallower soundings have been made at distances sixty miles north and east of it.

A similar depression has been sounded during the last few years west of the great range of the Andes, at a distance of fifty miles from the coast of Peru, where the greatest depth is 4,175 fathoms (4¾ miles).

Other isolated depths of over 4,000 fathoms have been sounded in the Pacific. One between the Tonga or Friendly Islands of 4,500 fathoms, one of 4,478 fathoms near the Ladrones, and another of 4,428 fathoms near Pylstaart Island, all in the Western Pacific. They all require further investigation to determine their extent.

To give an idea of what remains to be done, I will mention that in the eastern part of the Central Pacific there is an area of 10,500,000 square miles in which there are only seven soundings, whilst in a long strip crossing the whole North Pacific, which has an area of 2,800,000 square miles, there is no sounding at all. Nevertheless, while the approximate mean depth I am mentioning may be considerably altered as knowledge increases, we know enough to say that the Pacific is generally deeper than the other oceans. The immensity, both in bulk and area, of this great mass of water, is difficult to realise; but it may assist us when we realise that the whole of the land on the globe above water level, if shovelled into the Pacific, would only fill one-seventh of it.

The temperature of the ocean is interesting.

The temperature of the surface is most important to us, as it is largely on it that the climates of the different parts of the world depend. This is comparatively easy to ascertain. We know so much about it that we are not likely to improve on it for many years. We are quite able to understand why countries in the same latitude differ widely in their respective mean temperatures; why fogs prevail in certain localities, and others are subject to tempestuous storms.

On the latter point nothing has come out plainer from recent discussion than the fact that areas where great differences of surface temperature of the sea prevail are those in which storms are generated.

A remarkable point recently brought to light by the researches of Mr. John Murray in Scotch lochs is the effect of wind on the surface temperature. It has been observed that wind driving off a shore drifts the surface water before it. This water is replaced by the readiest means, that is to say, by water from below the surface rising to take its place. As the lower strata are in all cases cooler than the surface a lowering of the temperature results, and we find, in fact, that near all sea-shores off which a steady wind blows the water is cooler than further to seaward.

This has an important bearing on coral growth, and explains why on all western coasts of the great continents off which the trade winds blow we find an almost absolute dearth of coral, while on the eastern coasts, on which warm currents impinge, reefs abound, the coral animal flourishing only in water above a certain temperature.

In the meantime we can state certain known facts.

The depth of the warm surface water is small.

In the equatorial current between Africa and South America, where the surface is of a temperature of 78°, at 100 fathoms it is only 55°, a difference of 23°, and a temperature of 40° is reached at 400 fathoms. In this region, as far as knowledge goes, the fall in temperature as we descend is most rapid, but generally speaking the same variations prevail everywhere.

In the tropical Pacific the temperature falls 32° from the surface, where it stands at 82°, to 50° at a depth of 200 fathoms, and to 40° at from 500 to 600 fathoms below the surface. Below the general depth of from 400 to 600 fathoms, the temperature decreases very slowly, but there is considerable variation in the absolute amount of it when we get to great depths in different parts of the ocean.

It is interesting that the investigation into the translation of the great seismic wave caused by the eruption of Krakatoa in 1883 led to a similar and entirely independent conclusion. The wave caused by the explosion in the Straits of Sunda reached Cape Horn, where by good chance a French meteorological expedition had erected an automatic tide gauge, but instead of one series of waves being marked on the paper there were two. A little consideration showed that the South Pole having directly interposed between Sunda Straits and Cape Horn, the waves diverted by the land about the pole would arrive from both sides.

One wave, however, made its appearance seven hours before the other.

Study showed that the earliest wave coincided in time with a wave travelling on the Pacific side of the pole, with a velocity due to the known depth, while the later wave must have been retarded in its journey *vid* the South Atlantic. The only possible explanation is that the wave had been impeded by comparatively shallow water.

In the great oceans the greatest cold is found on the western side of the South Atlantic, where the thermometer stands at 32°·3 F., but temperatures of 29° F. have been obtained of recent years east of the Færoe Islands, north of the ridge which cuts off the deeper waters of the Arctic from the Atlantic.

The waves which for ever disturb the surface of the sea demand much study.

The greatest of these, and the most regular, is the tidal wave. On this many powerful intellects have been brought to bear, but it still presents many unsolved anomalies.

Lord Kelvin and Professor Darwin have demonstrated that the tidal movement is made up of many waves depending upon different functions of the moon and sun, some being semi-diurnal, some diurnal. The time of transit over the meridian, the declination of both bodies, create great variations ; the changing distance and position of the moon and the position of her node, also have great effect, while the ever-varying direction and force of the winds, and the different pressure of the atmosphere, play their part, and sometimes a very large part, on what is somewhat loosely known as the meteorological tide.

Though after long observation made of the times and ranges of tides at any one spot, they can now be predicted with great accuracy, for that particular place, by the method of harmonic analysis, perfected by Professor G. Darwin, the meteorological tide excepted, no one can yet say what the tide will be at any spot where observations have not been made.

The waves due to wind, though not so far-reaching in their effects as the

majestic march of the tide wave, are phenomena which are more apparent to the traveller on the ocean.

The deep sea in a heavy gale presents, perhaps, the most impressive manifestation of the powers of nature which man can behold, and doubtless many of us have experienced feelings that may vary from awe and wonder to sheer delight, according to the temperament of each individual, at for the first time finding himself face to face with this magnificent sight, though I rather fear that discomfort is the prevailing feeling that many carry away.

The height to which storm waves may rise has never been satisfactorily determined. Apart from the difficulty of the task and the small number of people who will address themselves to it when they have the chance, it is but rarely that any individual sees really abnormal waves, even though he may be at sea all his life.

Different heights for what are called maximum waves have been recorded, and they vary from 40 to 90 feet from crest to hollow.

All we can say is that the most probable figure is about 50 or 60 feet.

These great storm waves travel very far. In some cases they convey a warning, as their velocity always far exceeds that at which the storm is travelling. In others they intimate that a gale of which no more is seen has occurred somewhere—it may be many miles distant.

When they have travelled beyond the limits of the wind which raised them, they lose the steepness of slope which characterises them when under its influence, and become an undulation which is scarcely noticed when in deep water.

On approaching shallow water, however, they are again apparent, and the "rollers" that occur unperiodically at various places in latitudes where gales never occur would seem to be caused by such waves, originating in areas many thousands of miles distant. Such appears to be the originating in areas many rollers at Ascension and St. Helena, where the rocky and exposed nature of the landing has caused this phenomenon to be especially noticed.

Other rollers are, however, undoubtedly due to earthquakes or volcanic eruptions occurring in the bed of the sea.

The variations in the pressure of the atmosphere play an important part in changes of sea level.

A difference of one inch in the barometer has been shown to be followed by a difference of a foot in the mean level of the sea, and in parts of the world where the mean height of the barometer varies much with the seasons, and the tidal range is small, this effect is very marked.

Of any secular change in the level of the sea little is known. This can only be measured by comparison with the land, and it is a question which is the more unstable, the land or the water—probably the land, as it has been shown that the mass of the land is so trifling, compared with that of the ocean, that it would take a great deal to alter the general mean level of the latter.

THE MAY FROST OF 1894.

To the Editor of the Meteorological Magazine.

SIR,—To answer the question put by Mr. Harold Smith in the August Magazine as to the strength of the wind at Easton Mauduit, on May 21st, during the daytime between the two severe night frosts, I may reply that the "wind" entries in my register (made by estimate. not by instruments,) show a force at 9 a.m. of 3, and during the whole day of 2 (on scale 0–12), *i.e.*, there was a light breeze at 9 a m. which lessened as the day went on. It was the quietest day of the period, 19th to 24th. The 22nd showed 3 and 4 respectively, and the two next days 5 and 4, which, by estimate, means a considerable wind, but nothing like a gale. I give these figures as being good for comparison between themselves, but not as of precise absolute value.—Yours sincerely,

H. A. BOYS.

Easton Mauduit Vicarage, Northampton, Aug. 28th, 1894.

To the Editor of the Meteorological Magazine.

SIR,—Although it is rather late to be talking about the May frost, yet, having noticed in your Magazine for June the low temperatures given for different parts of the country on 21st of May and following nights, I cannot refrain from drawing your attention to the comparative freedom of London, and especially South London, from severe frosts during that period, the lowest temperature taken by me being 35°, on the night of the 20–21st May, the shed in which the thermometer hung being open to the N.E. wind, which was blowing at the time. I notice that this is even two degrees higher than the value given by you for North-west London on the same date.

This position is at the summit of the hill, and fully exposed, yet nothing in the garden was damaged.

I am, yours faithfully,

AN AMATEUR METEOROLOGIST.

Clapham Park, S. W., July 7th, 1894.

[This is another illustration of the variability of temperature in and around the metropolis. It was 32°·3 at GreenwichObservatory, 33°·0 at Camden Square, 35°·0 at Clapham, and 36°·0 at Acre Lane, Brixton]

AN INDICATION OF RAIN.

To the Editor of the Meteorological Magazine.

SIR,—I find hereabouts a general belief that when corn in sheaves on the field dries rapidly in the morning rain may be expected. This seems to be contrary to all sound theory. The above conditions obtained yesterday, rain following. It was triumphantly argued to me that the popular belief must be correct.—Your obedient servant,

DUCIE.

Tortworth Court, Falfield, Glos., Sept. 5th, 1894.

THE VIENNA HAILSTORM OF JUNE 7TH.

In the latest *Meteorologische Zeitschrift*, Dr. Hann, chief of the Austrian Weather Department, has given some interesting particulars relating to the terrific and destructive hailstorm, accompanied by a perfect hurricane and thunder and lightning, which visited Vienna on the morning of June 7th last. The storm is shown to have travelled from west to east. Originating apparently about 9.30 p.m. on the 6th in Wurtemberg it passed over Munich shortly before 3 a.m., the wind blowing in very severe squalls, rain and hail falling like a deluge, and in ten minutes there were more than 80 flashes of lightning. Travelling at the rate of 35 miles an hour, the disturbance reached Gmunden, but the storm was not violent here, and only a little rain fell. The distance of 120 miles from Gmunden to the Austrian capital was covered in 1hr. 40min., or at the rate of 72 miles an hour, the average rate for the whole distance from Munich being 48 miles an hour. Around Vienna the storm broke about 6.30 a.m., and a few minutes after 7 o'clock it was all over. There are a number of observers in and about the city, and few of them reported less than an inch of water, one or two from rain alone, the others from rain and melted hail. The largest totals were 1·71in. in the Rathhauspark and 1·67in. in the Skodagasse, Josefstadt. At the central office, Hohe Warte, 0·4in. fell in 16 minutes, but at the Schmelz Reservoir the hail, which came down between 6.35 and 6.50 a.m., yielded 1·47in. of water, or at the rate of nearly six inches per hour. Further afield, at Purkersdorf, however, Mr. Francis A. Heath, C.E., had a total of 1·26in., but in five minutes, 6.45 to 6.50 a.m., he measured the enormous quantity of 1·1in., or at the rate of more than 13 inches an hour. At Mariabrunn, the Imperial Experimental Forest Station, 1·48in. was registered in 20 minutes.

INTERNATIONAL METEOROLOGICAL COMMITTEE.

The International Meteorological Committee held its meeting, as arranged, at Upsala, on August 20—24. M. Wild, the president, was unfortunately prevented from attending, owing to indisposition. M. Mascart was elected president for the meeting and Mr. Scott, as usual, secretary. The principal points dealt with at the meeting were as follows:—1. The establishment of an international meteorological bureau was recognized as impracticable. 2. It was resolved to publish in the report of the meeting a *résumé* of the measures adopted in all countries to communicate to agriculturists meteorological results likely to be useful to them. 3. The acceleration of meteorological telegrams. It was decided to address the international telegraphic bureau at Berne on this subject. 4. "The scintillation of stars as an indication of weather," a paper by M. C. Dufour, will be reproduced in the report. 5. The study of clouds. This was the great feature of the meeting. The cloud committee appointed at Munich in 1891 held a meeting at the same time as the International Meteorological Committee, and presented a report dealing with definitions for the ten classes (Hildebrandsson and Abercromby) adopted at Munich, and with instructions for cloud observations. They also proposed to prepare and issue an authoritative cloud atlas. This report was, with some modification, adopted. 6. The subject of the treatment of the wet bulb below the freezing point was discussed, and the use of Ekholm's formula was recommended *ad interim*. 7. It was decided to arrange for a conference of the same character as that at Munich in 1891, which was not an official congress, to be held in Paris in September, 1896.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1894.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	65·8	31	28·6	3	54·2	36·0	38·9	81	108·8	22·1	1·19	9	4·8
Malta	68·3	14	41·7	29	62·0	51·2	46·1	74	131·6	36·6	1·49	11	5·8
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	84·5	21	68·1	19	82·4	72·5	69·3	78	133·3	59·6	3·99	17	5·4
Calcutta	98·8	24	59·8	9	92·0	69·6	66·5	66	153·5	50·1	1·50	2	2·1
Bombay	91·0	25	67·6	12	86·4	74·3	69·7	71	140·0	61·4	·06	3	1·9
Ceylon, Colombo	90·8	15	72·0	12	88·3	74·9	72·2	77	152·0	64·0	7·44	11	4·5
Melbourne	93·0	8	47·3	29	75·5	56·9	54·9	69	146·5	37·9	·88	8	6·5
Adelaide	96·2	12	52·8	27	80·3	60·4	53·4	55	155·5	46·8	1·59	12	4·6
Sydney	83·0	7	57·8	26	73·8	64·2	61·2	81	145·2	48·5	11·58	25	6·6
Wellington	72·0	5*a*	44·3	31	67·3	55·2	51·7	72	132·0	33·0	4·07	10	4·2
Auckland	76·0	2	51·0	22	71·6	57·5	58·8	81	144·0	49·0	1·42	9	4·8
Jamaica, Kingston	87·7	6	61·2	9	83·9	66·6	66·4	78	...	...	·74	4	3·4
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	63·4	18	14·1	26	43·1	28·4	29·6	76	...	10·0	1·33	19	7·0
New Brunswick, Fredericton	64·7	6	1·5	31	40·5	20·1	23·2	68	...	...	1·87	12	6·0
Manitoba, Winnipeg	40·4	2	—20·5	25	29·8	9·5	...	...	...	...	1·63	10	6·0
British Columbia, Esquimalt	56·9	25	29·2	3*b*	47·3	35·2	37·3	86	...	...	4·64	25	7·0

a And 7. *b* And 6.

REMARKS.

MALTA.—Adopted mean temp. 54°·9, one degree below the average of 10 years; cloud and rainfall above the average. Mean hourly velocity of wind 9·8 miles. Thunderstorm on 13th; L on 22nd and 30th; H on 25th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·5 below, dew point 0°·5 below, and rainfall 3·97 in. below, their respective averages. Mean hourly velocity of wind 10·7 miles, or 0·8 mile above average; extremes, 29·3 on 12th, and 0·0 on 1st; prevailing direction, E.S.E. T and L on the 11th and 22nd, and L on 13th and 30th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 13th, 14th and 28th. Thunderstorms occurred on 6 days. D. G. MANTELL.

Melbourne.—Lightning on the 5th, 8th and 18th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·1 below the average of 37 years, and rainfall ·55 in. above the average. The first half of the month was warm and dry, the second half cool and wet. C. TODD, F.R.S.

Sydney.—Temperature 0°·2 below, humidity 5 above, and rainfall 5·97 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Fine up to the 6th, then showery with fine intervals up to the 18th, when 2·55 in. of R fell; fine for the remainder, except showers on 26th, 27th and 28th. Prevailing wind N.W. Mean temperature 0°·9 below, and rainfall ·97 in. above, the average. R. B. GORE.

Auckland.—An unusually fine and dry month, the rainfall being more than an inch below the average. Mean temp. slightly below, and barometrical pressure slightly above, the average. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 3·9 miles, prevailing direction S.S.E. Rainfall in Kingston half the average, but over the Island as a whole the average fall was received. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·39	XI.	Rhayader, Nantgwillt..	...
,,	Birchington, Thor	1·70	,,	Lake Vyrnwy	4·51
,,	Hailsham	2·38	,,	Corwen, Rhug	2·44
,,	Ryde, Thornbrough	2·62	,,	Carnarvon, Cocksidia ...	3·20
,,	Emsworth, Redlands ...	1·93	,,	I. of Man, Douglas	3·06
,,	Alton, Ashdell.....	3·22	XII.	Stoneykirk, Ardwell Ho.	2·11
III.	Oxford, Magdalen Col...	2·30	,,	New Galloway, Glenlee	3·91
,,	Banbury, Bloxham	2·53	,,	Melrose, Abbey Gate...	5·50
,,	Northampton, Sedgebrook	2·07	XIII.	N. Esk Res. [Penicuick]	5·50
,,	Alconbury	2·66	,,	Edinburgh, Blacket Pl..	3·83
,,	Wisbech, Bank House..	2·05	XIV.	Glasgow, Queen's Park.	4·87
IV.	Southend	2·51	XV.	Inverary, Newtown	5·96
,,	Harlow, Sheering	2·61	,,	Islay, Gruinart School..	...
,,	Colchester, Lexden.....	1·45	XVI.	Dollar.....	5·25
,,	Rendlesham Hall	2·51	,,	Balquhidder, Stronvar..	4·99
,,	Diss	2·06	,,	Ballinluig	4·68
,,	Swaffham	2·28	,,	Dalnaspidal H.R.S. ...	6·48
V.	Salisbury, Alderbury...	1·86	XVII.	Keith H.R.S.	5·14
,,	Bishop's Cannings	2·60	,,	Forres H.R.S.	3·90
,,	Blandford, Whatcombe.	1·83	XVIII.	Fearn, Lower Pitkerrie.	3·86
,,	Ashburton, Holne Vic....	5·32	,,	Loch Shiel, Glenaladale	9·25
,,	Okehampton, Oaklands.	4·40	,,	N. Uist. Loch Maddy ...	4·92
,,	Hartland Abbey	4·24	,,	Invergarry	4·75
,,	Lynmouth, Glenthorne.	4·49	,,	Aviemore H.R.S.	4·84
,,	Probus, Lamellyn	3·67	,,	Loch Ness, Drumnadrochit	5·55
,,	Wellington, Sunnyside..	3·85	XIX.	Invershin	4·47
,,	Wincanton, Stowell Rec.	2·57	,,	Scourie	5·21
VI.	Clifton, Pembroke Road	3·26	,,	Watten H.R.S.	3·35
,,	Ross, The Graig	2·97	XX.	Dunmanway, Coolkelure	3·42
,,	Wem, Clive Vicarage ...	3·28	,,	Fermoy, Gas Works ...	3·08
,,	Cheadle, The Heath Ho.	2·61	,,	Killarney, Woodlawn ...	3·14
,,	Worcester, Diglis Lock	2·30	,,	Tipperary, Henry Street	...
,,	Coventry, Coundon	2·97	,,	Limerick, Kilcornan ...	3·09
VII.	Ketton Hall [Stamford]	2·00	,,	Ennis..... .	...
,,	Grantham, Stainby	3·90	,,	Miltown Malbay.....	3·95
,,	Horncastle, Bucknall ...	2·72	XXI.	Gorey, Courtown House	4·03
,,	Worksop, Hodsck Priory	2·03	,,	Athlone, Twyford	3·13
VIII.	Neston, Hinderton	3·41	,,	Mullingar, Belvedere ...	3·85
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	3·96
,,	Broughton-in-Furness..	6·61	XXII.	Galway, Queen's Coll...	4·19
IX.	Ripon, Mickley	2·40	,,	Crossmolina, Enniscoe..	3·13
,,	Scarborough, South Cliff	3·38	,,	Collooney, Markree Obs.	2·31
,,	East Layton [Darlington]	2·37	,,	Ballinamore, Lawderdale	2·82
,,	Middleton, Mickleton..	2·97	XXIII.	Lough Sheelin, Arley ..	2·96
X.	Haltwhistle, Unthank..	5·04	,,	Warrenpoint	2·10
,,	Bamburgh.....	3·14	,,	Seaforde	2·25
,,	Keswick, The Beeches...	6·34	,,	Belfast, Springfield	2·36
XI.	Llanfrechfa Grange	4·19	,,	Bushmills, Dundarave...	2·90
,,	Llandovery	4·79	,,	Stewartstown	1·57
,,	Castle Malgwyn	3·73	,,	Buncrana	2·90
,,	Builth, Abergwessin Vic.	5·58	,,	Lough Swilly, Carrablagh	3·63

AUGUST, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERAT Max. Deg.	Max. Date	Deg
			inches.	inches.	in.					
I.	ENGLAND.	London (Camden Square) ...	2·85	+ ·97	·90	23	18	79·3	14	44·
II.		Maidstone (Hunton Court)...	1·55	— ·14	·28	10	13	...	...	...
,,		Strathfield Turgiss	2·56	+ ·85	·72	24	22	77·1	14	39·
III.		Hitchin	4·18	+ 2·36	1·06	10	18	75·0	26	44·
,,		Winslow (Addington)	2·32	+ ·35	·48	23	17	75·0	24	40·
IV.		Bury St. Edmunds (Westley)	3·17	+ ·97	·70	23	21	72·0	14	47·
,,		Norwich (Brundall)	2·17	...	·72	23	21	75·6	14	45·
V.		Weymouth(LangtonHerring)	3·17	+ 1·24	1·62	25	12	71·0	28	47·
,,		Torquay (Cary Green)	3·31	...	·94	24	14	71·6	31	50·
,,		Polapit Tamar [Launceston]..	4·11	+ 1·63	·76	25	20	74·0	31	51·
VI.		Stroud (Upfield)	3·13	+ 1·04	·51	25*a*	22	71·0	1	42·
,,		ChurchStretton(Woolstaston)	3·94	+ 1·18	1·00	25	16	69·0	26*b*	46·
,,		Tenbury (Orleton)	2·72	+ ·60	1·07	25	16	72·7	30	41·
VII.		Leicester (Barkby)	2·12	— ·32	·35	5	24	75·0	14*c*	38·
,,		Boston	2·16	+ ·04	·30	25	23	75·0	10	45·
,,		Hesley Hall [Tickhill].....	1·75	— ·41	·51	25	17	71·0	1	41·
VIII.		Manchester(PlymouthGrove)	3·80	+ ·71	·70	1	23	70·0	4,5	45·
IX.		Wetherby (Ribston Hall) ..	2·46	+ ·12	·39	9	15	...	...	...
,,		Skipton (Arncliffe)	5·33	+ 1·00	·90	2	20	...	...	...
,,		Hull (PearsonPark)	2·22	— ·42	·50	25	18	71·0	30	41·
X.		Newcastle (Town Moor)	3·12	+ ·41	·63	9	21	...	...	...
,,		Borrowdale (Seathwaite).....	13·10	+ 4·65	2·47	2	23	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·96	+ 1·35	1·36	25	21	...	...	...
,,		Haverfordwest	4·17	+ ·99	·99	24	23	70·0	1	40·
,,		Aberystwith (Gogerddan) ...	4·70	...	1·10	12	19	74·0	22	37·
,,		Llandudno.....	2·66	+ ·30	·57	25	23	66·2	6	49·
XII.	SCOTLAND.	Cargen [Dumfries]	3·38	+ ·39	1·50	2	16	69·8	9	39·
,,		Jedburgh (Sunnyside).....	5·55	+ 3·31	2·97	2	17	72·0	1	39·
XIV.		Colmonell	3·09	...	1·28	2	17	73·0	8,24	39·
XV.		Lochgilphead (Kilmory).....	5·89	+ 1·33	1·87	13	19	...	...	37·
,,		Mull (Quinish).....	5·71	+ 1·56	1·76	13	24	...	...	...
XVI.		Loch Leven Sluices	4·00	+ 1·06	1·40	3	11	...	...	...
,,		Dundee (Eastern Necropolis)	4·50	+ 1·93	1·20	2	17	70·1	29	43·
XVII.		Braemar	5·53	+ 2·20	1·92	2	21	66·0	29	33·
,,		Aberdeen (Cranford)	4·75	...	1·87	2	18	68·0	8,13	41·
XVIII		Strathconan [Beauly]	4·37	+ 1·07	·72	9	17	...	...	...
,,		Glencarron Lodge.....	8·60	...	1·38	11	27	65·8	1	39·
,,		Cawdor [Nairn]	4·51	+ 2·26	·84	9	23	...	...	...
XIX.		Dunrobin	3·76	+ 1·36	·52	11	16	65·5	1	44·
,,		S. Ronaldsay (Roeberry).....	3·22	+ ·66	·71	19	21	62·0	7	47·
XX.	IRELAND.	Darrynane Abbey.....	4·32	...	·76	21	23	...	...	...
,,		Waterford (Brook Lodge) ...	3·19	— ·23	1·00	24	16	69·0	19	44·
,,		O'Briensbridge (Ross)	3·40	...	·58	25	21	..	...	...
XXI.		Carlow (Browne's Hill)	3·14	+ ·17	1·13	25	17	...	...	...
,,		Dublin (FitzWilliam Square)	3·73	+ 1·21	1·37	25	18	67·9	8	47·
XXII.		Ballinasloe	3·44	+ ·26	·98	25	20	68·0	5,9	47·
,,		Clifden (Kylemore)	5·29	...	·70	7	24	...	...	...
XXIII		Waringstown	1·82	— 1·29	·26	25	23	77·0	4	40·
,,		Londonderry (Creggan Res.).	2·90	— 1·22	·32	8	27	...	...	...
,,		Omagh (Edenfel)	2·44	— 1·05	·38	9	25	67·0	2	37·

a And 27. *b* And 30. *c* And 26. *d* And 21. *e* And 30. *f* And 23. *g* And 31.

+*Shows that* the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A showery month with a large rainfall. Wild flowers very luxuriant. Harvest much impeded by R; crops generally very good, but much laid by heavy R. TS on 25th. Swifts departed on 6th.

HITCHIN.—Between 7 a.m. and 10 a.m. on 25th 1·58 in. of R fell, with a few flashes of L.

ADDINGTON.—Weather very unsettled, and hindering for the finishing of hay-making until the last week, which was fine.

BURY ST. EDMUNDS.—Twenty-one days of R in the harvest month has been most disastrous for the Eastern Counties; the most damage was done from the 22nd to the 26th, which period was very wet and almost without wind. Barley much grown and discoloured. Distant T on 9th, TS on 10th.

NORWICH, BRUNDALL.—A very unsettled month; frequent R, though heavy only on the 23rd. Day temperatures remarkably low, only reaching 70° or upwards on five days, against 18 days in 1893. T, L, R and H on the morning of the 20th.

LANGTON HERRING.—At 9 a.m. on the 25th ·89 in. of R was measured, and on the 26th 1·62 in.; the R began at 3.45 a.m. on the 25th, and ceased at 11.30 p.m. on the same day, so that 2·51 in. fell on the 25th. No damage, however, was done here, but the floods caused great destruction of property at Beaminster and Bridport. The temp. was remarkably uniform through the month, and the mean at 9 a.m. (60°·4) was 1°·7 below the average. Two heavy TSS occurred on the 25th; fogs on 4th, 8th and 23rd. The last six days of the month were very fine.

TORQUAY, CARY GREEN.—R ·39 in. above, and wet days 1 below, the average. Mean temp. 60°·1, or 0°·3 below the average. Amount of sunshine 156 hours 35 minutes, being 31 hours below the average; three sunless days.

POLAPIT TAMAR.—An unusually wet month, but the last six days were beautifully fine, dry and warm, typical harvest weather. The R on the 25th was particularly heavy, lasting not more than 3 or 4 hours.

WOOLSTASTON.—A cold and stormy month, with very little sunshine, and very unfavourable for harvest. The last week was dry and much warmer. A very heavy R with T and L occurred on the 25th. Mean temp. 56°·9.

TENBURY, ORLETON.—A very cold ungenial month. Although there was not much more than the average quantity of R, the ground never got dry because there was no sun. The ther. never reached 70° until the 26th, and only upon three days after that date. A great storm occurred on the night of the 25th, with very heavy R, T and L.

LEICESTER, BARKBY.—Continuous R till the last few days, and the nights generally warm. Mean temp. 58°·7. T and L three times in the second week.

SEATHWAITE.—More than two inches of R fell on the 2nd and 14th, and more than one inch on the 5th, 7th and 13th.

WALES.

HAVERFORDWEST.—A wet hinderable month, and much hay spoiled; the more to be deplored as the crops were fine and very heavy. The wind blew throughout the month from S. and S.W., and the climatic conditions were very relaxing, although the temp. was never high, 70° being reached only on one day. Corn crops very heavy with abundance of straw, but much beaten down during the disastrous rains which fell uninterruptedly from the 19th to 27th. Sharp TS on the night of the 24th from 10 p.m. to midnight, the L very vivid with a deluge of R. The weather changed on the 28th to N.E. wind with fine clear sky.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout the month.

SCOTLAND.

CARGEN.—The first three weeks of the month were wet and damp, although the rainfall each day was generally small; the latter part of the month was fine. Sunshine was considerably deficient, and temp. much below the average. Conditions were very unfavourable for ripening the crops. TS on the 15th at 5 p.m.

JEDBURGH.—The month was marked by great unsettledness of weather, and was unfavourable to the agriculturist, whose harvest operations were much retarded. A large portion of the crop was still uncut at the close. The night temp. was generally low. T and L on the 17th. T on 28th and 29th.

BRAEMAR.— A wet cold month. Duration of sunshine 100 hours.

ABERDEEN, CRANFORD.—From 9 p.m. on the 2nd to 6 a.m. on the 3rd, 1·85 in. of R fell, and on the 8th, between 2 p.m. and 3 p.m., ·23 in. fell in five minutes, in the fom of H about the size of peas, accompanied by T.

ROEBERRY.—Wet and cold until the 19th, afterwards cold and dry with northerly winds. Mean temp. 54°·6.

IRELAND.

DARRYNANE ABBEY.—Cold and wet to the 25th, thence to the end very fine and warm, with little or no wind, and remarkably calm sea.

WATERFORD, BROOK LODGE.—L at night on 24th; a heavy TS on 25th. Thick ground fog on 26th, fog on 27th, thick fog on the morning of the 31st.

O'BRIENSBRIDGE, ROSS.—R moderate during the month, but the almost total absence of sunshine made it one of the most unpleasant and difficult months on record for all harvesting operations; even in the last five rainless days there was not a gleam of sunshine.

DUBLIN.—A month of singularly cloudy skies, low mean temp., north-westerly winds, and a heavy rainfall. The ther. did not once reach 70° in the shade, while it failed to reach even 60° on as many as six out of the last seven days of the month. The mean temp. 57°·9, is 1°·8 below the average. High winds were noted on as many as 13 days, and attained the force of a gale on the 10th and 14th; T was heard on the 2nd; H fell on the 8th. A lunar halo was seen on the 21st.

EDENFEL.—Almost up to the close of the month, August was a continuance of the dull dropping sunless weather and saturated atmosphere of July; another wet month in fact, but with R 1·05 in. below the average. The saving of the late hay, as of the early, was the most difficult and expensive in 30 years, its abundance being much more than counteracted in value by its inferior condition. The magnificent harvest weather, however, which set in on the 29th and still continues (Sept. 6th), justifies for once the forecasts of the weather prophets.

ERRATA IN "METEOROLOGICAL MAGAZINE," 1893.

REGULAR TABLES.

Maidstone (Hunton Court) ...	Feby.	Total rain	*should be*	3·46 in.	*not*	3·65 in.
Cardiff (Ely)	Feby.	,,	,,	5·86 in.	,,	5·72 in.
Loch Leven Sluices	July	,,	,,	2·40 in.	,,	2·50 in.
,, ,, ...	Sept.	,,	,,	1·40 in.	,,	1·60 in.

SUPPLEMENTARY TABLES.

Northampton (Sedgebrook)...	Feby.	Total rain	*should be*	2·54 in.	*not*	2·51 in.
Harlow (Sheering)	Oct.	,,	,,	2·75 in.	,,	1·75 in.
Okehampton (Oaklands)	Mar.	,,	,,	·77 in.	,,	·73 in.
East Layton [Darlington] ...	July	,,	,,	2·84 in.	,,	2·48 in.
Dalnaspidal, H.R.S.....	Mar.	,,	,,	2·61 in.	,,	2·39 in.
Longford (Currygrane).....	April	,,	,,	1·00 in.	,,	·93 in.

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MONS'S
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TOBER, 1894.

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It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

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THE OBSERVATORY:

A Monthly Review of Astronomy.

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SYMONS'S
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PROTECTION FROM LIGHTNING.*

As it is nearly thirteen years since the Report of the Lightning Rod Conference † was published, and as electrical knowledge has greatly increased during that period, we have read Prof. McAdie's work with great interest; and we hope that the Weather Bureau will place some copies on sale in this country, because we think that they would be of general utility.

Most of our readers have heard of—some of them have been privileged to see—the brilliant experiments upon electrical discharges devised and carried out by Prof. Oliver Lodge, F.R.S., and one's first curiosity is to see whether Prof. McAdie considers that Prof. Lodge's experiments have subverted the rules laid down by the Lightning Rod Conference. We see no sign of it. Prof. McAdie renders, as is quite right, full recognition to Prof. Lodge's good work; but when he has to approach the practical part—the laying down of the rules—he does so by the three following sentences:—

> "In 1882 appeared the report of the Lightning Rod Conference; in many respects the most important contribution to the literature of the subject yet made. While so many foreign governments, and in particular France, had by means of officially constituted boards, taken a governmental interest in the protection of the people from the dangers of lightning, the English-speaking people of the world, aside from the few directions officially issued for the protection of magazines and lighthouses, remained without any authoritative utterance upon the subject; and while this conference itself did not have strictly official sanction, it carries, from the character of its make-up, a weight certainly as great, if not greater, than an official board. It was simply a joint committee of representative members of the Institute of British Architects, the Physical Society, the Society of Telegraph Engineers and Electricians, the Meteorological Society, and two co-opted members. As might be anticipated from such auspices, the report is an excellent one, and must stand for years as the embodiment of the most widely gathered information and well-considered decisions. The report is emphatically one based upon *experience*.

* U.S. Department of Agriculture, Weather Bureau. Circular of Information. Protection from Lightning, by Alexander McAdie, U.S. Weather Bureau, Washington, D.C., 1894. 8vo, 20 pages and 11 pages of plates.

† E. and F. N. Spon, London, 1882, 8vo.

"The famous free-for-all discussion which occurred at the British Association Meeting in 1888, so far as our judgment goes, simply proved that the decisions of the conference could not at present be disregarded. As the president of the meeting, Sir William Thomson, said, we have 'very strong reason to feel that there is a very comfortable degree of security, if not of absolute safety, given to us by lightning conductors made according to the present and orthodox rules.'

"There are one or two further features to which attention may be called. There are some very prevalent misapprehensions with regard to lightning. For example: that it never strikes twice in the same place; that the most exposed place is always struck; that a few inches of glass or a few feet of air will serve as a competent insulator to bar the progress of a flash that has forced its way through a thousand feet of air, etc. These are alluded to in the following general directions."

We have not space to reprint Chapter III., and, as we have above said, we hope that our readers may be able to procure the whole pamphlet. We, therefore, limit ourselves to noting the few portions of it with which we do not agree. In Section II. we read:—"Use a good iron or copper conductor. If the latter, one weighing about 6 ounces to the foot, and preferably in the form of tape. If iron is used, *and it seems to be in every way as efficient as copper*, have it in rod or tape form, and weighing about 35 ounces to the foot."

The above weights are practically identical with those recommended by the Lightning Rod Conference (6 oz. and $2\frac{1}{4}$ lbs.); but we do not understand the words which we have printed in italics. If iron is "in every way as efficient," why have six times as much of it as of copper? The great objection to iron is its deterioration by rust. Except upon Government powder magazines, we may say that practically no lightning conductor is examined after it has once been put up. We think that very possibly *while new* an iron band seven times as large as a copper one would be more effective than a copper one; but let 10, 20, 30 years pass, and where would be safety with the iron? while the copper would be as good as on the first day.

Section V., attributed to Prof. Lodge, is really an epitome of the recommendation of the Lightning Rod Conference. (See its Report, bottom of page 11 and top of page 12.)

Section X.—"Area of protection. . . . Many lightning rod manufacturers consider that the rod protects an area of radius equal to the height. The truth is that buildings are struck sometimes within this very area, and we now hold [that] there is no such thing as a definite protected area." Prof. McAdie here accepts as a proved truth that which previously has never been so authoritatively stated. We should be glad to be referred to the facts upon which this sweeping assertion is based.

It must not be supposed that this pamphlet is merely a code of rules—quite the contrary; it contains statistical tables of loss by lightning in the United States, deaths (average 200 annually), pecuniary loss by fire about $1\frac{1}{2}$ million dollars (£312,000 per annum).

There is a very clear account of the accident to, and the present protection of, the great Washington monument (555 ft. high), and there is a charming series of lithographs and photographs, with too little said about them.

THE RECENT DROUGHT IN THE MIDLANDS.

To the Editor of the Meteorological Magazine.

SIR,—It is strange that the recent spell of dry weather in parts of the Midland district shonld have attracted so little attention. Had it not been for the threatened water famine at Leicester, it seems likely that it would have passed altogether without notice by the Press. During the 26 days from August 27th to September 21st we had only one shower here, yielding 0·06 in. in the gauge. The nearest approach to this during the dry time (it could hardly be called a drought here) last year was the period between March 17th and April 13th, with a total of 0·09 in. Rain fell only on 4 days in September, and the total fall was 0·69 in. There was only one month last year with a smaller total, viz., April, of which the total was 0·47 in.

It is a pity that some of the duplicate meteorologists in and about London cannot be transferred to outlying and poorly-manned districts. As it is, anything exceptional occurring in the S.E. of England is apt to assume an exaggerated importance, while equally or more important occurrences in the provinces, receive no notice at all. Even the forecasts of the Meteorological Office, excellent as they are on the whole, are occasionally too much coloured by the weather prevailing at the time in the London district. There is a good deal of human nature even in meteorologists.

G. T. RYVES, F.R.Met.Soc.,

Tean Vicarage, October 8th, 1894.

It is not improbable that Mr. Ryves is right as to the influence of surroundings upon writers. With forecasting we have nothing to do, but Mr. Ryves writes of a drought, and compares it with that of 1893, and brings in the Leicester water famine in support of the argument. We have therefore taken up the subject in earnest, and append the result. The station in our regular table nearest to Leicester is Barkby, about 4½ miles N.E. of the town; the record is perfect from January 1st, 1870, to September 30th, 1894; we can have no better guide for investigation, and we therefore give the monthly fall for the 25 years.

Rainfall at Barkby, Leicestershire.

Above Ground, 0·10 in. Above Sea Level, 221 ft. Observer, Rev. E. N. Pochin.

Year.	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	Mean.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January.	1·43	·68	3·52	2·22	1·58	2·52	2·18	3·01	1·67	1·18	2·00
Feb	1·45	1·17	2·19	1·11	1·48	1·42	2·22	2·01	1·30	2·02	1·64
March...	1·63	·92	1·44	1·56	1·08	·51	2·55	1·72	·66	·64	1·27
April ...	·50	2·37	2·74	·60	1·16	1·10	3·75	2·51	1·84	2·25	1·88
May ...	·52	1·27	1·52	2·17	1·08	1·46	·58	1·78	4·78	3·67	1·88
June ...	·57	4·65	4·19	2·88	·64	4·26	1·78	·74	1·64	3·77	2·51
July ...	1·06	4·64	4·92	2·09	·56	6·56	·63	2·66	1·51	2·71	2·73
August..	1·62	·59	2·54	2·51	2·60	1·14	1·51	2·53	6·93	3·57	2·55
Sept. ...	1·50	4·17	2·91	2·04	2·30	2·88	5·20	1·40	1·14	3·45	2·70
October.	3·66	1·84	3·52	1·83	1·85	4·74	1·49	1·32	2·52	·76	2·35
Nov.	1·27	1·34	3·22	2·34	1·86	3·71	2·84	2·31	3·08	1·29	2·33
Dec. ...	1·94	1·12	3·33	·36	1·89	1·70	4·50	1·53	1·63	1·15	1·92
Yearly Total	17·15	24·76	36·04	21·71	18·08	32·00	29·23	23·52	28·70	26·46	25·76

Year.	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	Mean.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
January.	·33	1·24	2·07	2·13	2·17	1·68	3·09	2·37	1·05	1·42	1·76
Feb.....	2·16	3·36	2·03	3·02	·91	2·41	·30	·57	1·43	1·89	1·81
March...	1·52	1·12	1·12	1·01	1·09	·88	2·39	1·61	2·26	4·08	1·71
April.. ..	1·51	1·16	3·06	2·13	1·59	1·83	1·80	1·02	3·68	3·18	2·10
May.....	1·39	1·08	1·62	1·68	·85	2·26	4·64	1·64	·88	3·69	1·97
June	4·09	2·20	4·13	3·76	1·04	2·33	2·03	1·27	1·79	·86	2·35
July.....	7·61	1·28	3·03	3·42	3·28	·09	3·02	·72	5·59	1·89	2·99
August..	1·57	5·09	1·92	1·15	2·17	4·03	2·01	1·33	2·38	2·79	2·44
Sept.....	5·46	2·21	2·68	4·32	·91	3·21	1·61	2·37	1·30	2·29	2·64
October.	5·16	2·66	5·46	1·80	1·23	5·39	4·51	1·81	·52	2·99	3·15
Nov. ...	1·58	2·20	3·14	3·76	1·52	2·78	2·05	1·69	3·28	·86	2·29
Dec.....	2·79	2·94	3·91	1·00	1·76	·58	3·47	1·43	1·71	1·85	2·14
Yearly Total	35·17	26·54	34·17	29·18	18·52	27·47	30·92	17·83	25·87	27·79	27·35

Year.	1890	1891	1892	1893	1894	Mean 1870-89	Least. Amt.	Least. Year.	Least in 1st 9 mth. Amt.	Least in 1st 9 mth. Year.
	in.	in.	in.	in.	in.	in.	in.		in.	
January.	2·38	1·69	1·03	1·52	1·32	1·88	·33	1880	10·28	1870
Feb.	·84	·13	2·52	2·32	1·77	1·73	·13	1891	12·48	1874
March...	2·12	1·10	1·00	·37	·89	1·49	·37	1893	12·90	1887
April ...	·82	2·07	·85	·30	1·67	1·99	·30	1893	13·06	1893
May.....	1·85	2·64	2·21	1·81	1·99	1·92	·52	1870	14·01	1884
June ...	1·79	3·36	2·96	·73	1·91	2·43	·57	1870	15·11	1894
July.....	2·50	2·24	2·75	2·70	2·34	2·86	·09	1885		
August..	2·59	3·27	1·41	1·57	2·12	2·50	·59	1871		
Sept. ...	1·64	1·18	2·03	1·74	1·10	2·67	·91	1884		
October.	1·37	4·89	3·79	2·23		2·75	·52	1888		
Nov. ...	3 07	2·62	1·04	1·91		2·31	·86	1889		
Dec.....	·49	3·33	1·25	1·80		2·03	·36	1873		
Yearly Total	21·46	28·52	22·84	19·00		26·56				

The first nine months of 1894 according to this record have been dry, but not nearly so dry as in the previous years ending with 4, for we have

1874.		1884.		1894.		average for 20 years.
12·48	...	14·01	...	15·11	..	19·47

and the last two columns in the table show that out of 25 years there have been five in which the first nine months were drier than they have been in 1894. So again, if we take the individual months there is not one month in 1894 which was unprecedentedly dry, while two of them, February and May, were above the average. The only thing that we can see in the least approaching justification for calling attention to a deficiency is the fact of one dry season following another dry season, but that is just what water works are intended to provide for. However, we are not here discussing why Leicester is short of water, but whether there has been in the Midland counties anything like the drought which we had in the South of England in 1893. It was shown in these pages, and by the map in *British Rainfall*, 1893, that the drought of 1893 was far less severe in Leicestershire than in the South, and yet the Barkby figures give for the driest four consecutive months of 1894 very nearly double the fall in 1893, 5·65 in. against 3·21 in.

That September, 1894, was dry, is amply shown by the table on page 142, for Seathwaite had only one-twentieth of its average, and actually had much less than Leicester, but we think that we have proved that there has not previously been during this year any exceptional drought in the Midland Counties, and therefore there had been nothing to overlook.

A DRY SEPTEMBER.

We have in the preceding note called attention to the remarkably small rainfall shown by the table on p. 142, and the supplementary table on p. 141 is equally striking. It in many respects resembled September, 1865, but at Northern and Irish stations surpassed it. Seathwaite, with an average for September of 11·73 in. and an actual fall of 0·59 in., or 1-20th of the average, seems a hard case to beat, but the following letter gives a still smaller proportion for Rothesay in Bute.

A DRY MONTH IN THE WEST OF SCOTLAND.

SIR,—In no part of Scotland was the deficiency of rainfall during September more marked than in that portion of the West Coast known as the Clyde sea area.

A rainfall register having been kept at Rothesay since the year 1800, we have reliable data for a West Coast station extending over the long period of 94 years. Previous to this year the smallest September rainfall noted was exactly one inch in the year 1865, while last month had but one-tenth of this small quantity and one forty-fifth of the average. The only months with a smaller downfall were those of April, 1842, and June, 1821; but April, 1873, and May, 1844, had the same rainfall as in September last. During the seven weeks ending on October 8th barely one-third of an inch of rain fell at Rothesay; while at Fort-William during this period only half an inch was measured, or in each instance about one-twentieth of the average. Edinburgh, on the other hand, had an inch and a quarter of rain during the period under review, or about a quarter of the average precipitation, many of the showers off the North Sea extending but a small way inland. Owing to the prevailing easterly winds but little sunshine was registered in Edinburgh, the sunshine recorded showing a daily average of three hours, but at the Ben Nevis Observatory four hours a day was attained.—I am, &c.,

R. C. MOSSMAN.

October 10th, 1894.

ENORMOUS HAILSTONES.

In the *Quarterly Journal of the Roy. Met. Soc.*, Vol. XV., p. 47, will be found description and full size engravings of some immense hailstones which fell about 50 miles S.E. of Paris on August 15th, 1888, and of which actual models to scale can be inspected at the rooms of the Society.

The stones seem to have been surpassed on August 26th, 1894, according to the *Journal d'Amiens* for August 30th, September 1st and 2nd, from which we proceed to translate a few statements :—

"The thunderstorm, accompanied by a cyclone (whirlwind), broke at 10 p.m., and for about half-a-mile blew down not only the trees, but the telegraph posts and the wires along the railway between Moreuil and Montdidier."

"Most of the hailstones weighed 200 grammes (7 oz.), they broke not merely the windows, but also the tiled roofs; and at Mézières

one which came through a window and broke a workbox is stated by the *Propaganda* to have weighed 1 kilo 200 grammes (2 lbs. 10 oz.)!"

"Sheep were killed, and the next day small birds and game could be picked up by the dozen."

"At Blancfosse (Oise) some of the hailstones weighed more than 300 grammes (10½ oz.)."

"At Beaucourt hailstones were picked up weighing nearly a kilogram (2 lbs.). Great as this appears, we are assured by a person well worthy of confidence that it is correct. Dead hares and partridges have been picked up."

"The damage at Mézières is estimated at 800,000 francs (£32,000), but in the official list it is given as 600,000 francs (£24,000), and the total for the arrondissement of Montdidier as 1,115,766 francs (£44,631)."

Further information is supplied by the following cuttings from *The Times* and the *Morning Post*:—

BRUSSELS, August 27th.—A storm of extraordinary violence yesterday passed over that portion of Belgium situated between Mons and the German frontier. The wind was of almost cyclonic character, and swept across the country, destroying everything in its path, along a well-defined track three kilometres in width. Several farms were struck by lightning and burned to the ground, while much damage was done also by the shower of enormous hailstones which accompanied the storm.

LIEGE, August 27th.—The storm which passed over the S.E. of Belgium yesterday caused considerable damage here. The atmospheric disturbance continued to-day, and the violence of the hurricane was especially felt in this city and the surrounding country. Many houses are flooded, streets are under water, and railway traffic is interrupted. The circular railway connecting the various stations is blocked by a wall having been blown down, and fallen across the line.

BERLIN, August 28th.—The unseasonable weather which has prevailed for the last five weeks throughout Germany has culminated in a series of violent hailstorms and hurricanes, which have done great damage in many parts of the country. At Crefeld the streets were flooded, and a building three storeys high collapsed. Near Breslau a railway carriage was driven down the line by the force of the wind, and three workmen were killed.

VIENNA, August 28th.—The excessive heat which has prevailed in Austria-Hungary during the last few days caused many cases of sunstroke. From Temesvar, in Hungary, it is reported that among the troops leaving for the manœuvres ten cases, three of which ended fatally, occurred during a march of 12½ miles. Yesterday, during the manœuvres, about 100 soldiers, the majority of whom belonged to cavalry regiments, were attacked by sunstroke.

BRUSSELS, August 28th.—Immense damage has been done by the recent storms over all the district between the Sambre and the Meuse, and in many cases the harvest has been completely destroyed by the hail.

PARIS, August 28th.—During the great storm which raged in France yesterday, the 117th Regiment of the line was on the march near Eventeul. The horses of the officers, frightened by the enormous hailstones, bolted across

country. A thoroughbred belonging to the colonel was so seriously injured that it is now unfit for further service. With such force did the hailstones fall that some of them pierced the trumpets and other brass instruments of the regimental band.

WHIRLWINDS.

To the Editor of the Meteorological Magazine.

SIR,—In your July issue, page 90, you have an interesting report on a whirlwind which occurred near Reigate on June 21st. Some person, who does not give his name, expresses his ideas as to the formation of these phenomena, founded on the conditions of this one. I regret having to differ from his conclusions: A calm day in June, on a hill side, "high and exposed, under a brilliant sun, and very warm," with its action on the air, is in summer time so very usual an occurrence, that we might expect a whirlwind in almost every hillside field in such weather. Mr. Burchall does not give the hour, but it curiously happens that at 5.0 p.m. on the same day, a similar phenomenon occurred at the racing grounds of the Athletic Club at Fulham, under, I fancy, as to locality, very different conditions, but apparently with as much force and effect. That at Fulham, however, showed a refined taste in selecting the music books of the band, and carrying their leaves to an inconceivable height. Both these reports were published in the *Times* within a few days of their occurrence. Now, Sir, my contention is that a whirlwind, such as these, is caused by a silent electric current of large volume, but of small intensity, passing from the earth to the higher atmosphere, the electricity in both positions, or places, being of opposite species, that in the earth, as in ordinary thunderstorms, being induced by that in the upper atmosphere; the discharge carries the air and its contents along with it, the whirling motion being given, as is well-known, by the unequal friction, or resistance, on the opposite sides of the current; the effect of this current on the air, giving it almost the force of a gale, was shown by the dilemma in which the poor rooks found themselves; it must have been stronger than anything we can imagine to arise from ordinary heated air. It is much to be desired that meteorologists would give more of their attention to the subject of atmospheric electricity, which, next to the heat and light of the sun, produces the greatest effects in meteorology, and is at present thoroughly ignored.

Yours faithfully,

ROBERT J. LECKY.

London, July 23rd, 1894.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1893.

Stations. *Those in Italics are South of the Equator.*	Absolute.				Average.					Absolute.		Total Rain.		Average.
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.										0—10
	°		°		°	°	°	°		°	°	in.		
England, London ...	93·6	August 18	15·4	January 5	60·6	43·2	51·9	43·2	76	134·3	10·0	19·80	148	5·3
Malta	98·8	September 25	39·0	January 19	73·0	59·6	66 3	56·5	75	148·8	36·3	25·30	80	3·9
Cape of Good Hope.	98·7	April 5	35·1	August 22	70·5	53·6	62·0	54·9	79	...	...	23·37	93	4·1
Mauritius	85·6	December 30	57·4	August 16	78·6	67·7	73·1	64·1	76	141·0	48·2	...	...	5·8
Calcutta	96·9	May 20	45·9	January 28	83·9	69·7	76·8	69·9	81	159·0	37·7	85·23	97	5·2
Bombay	94·6	April 16	57·9	February 8	85·3	74·1	79·7	70 9	76	149·0	49·3	67·24	124	3·9
Ceylon, Colombo ...	92·2	March 9	65·8	February 8	85·9	74·7	80·3	70·7	77	157·0	53·0	89·65	192	5·0
Melbourne	105·5	March 2	31·0	July 28	67·6	50·1	58·8	...	74	155·5	24·9	26·82	140	6·0
Adelaide.....	108·0	February 2	35·7	July 3	72·4	52·9	62·7	48·0	60	166·4	26·1	21·50	129	...
Sydney	93·6	December 6	38·7	July 4	68·8	56·2	62·5	53·6	78	153·0	24·0	49·91	208	4·8
Wellington.....	82·0	January 24	34·0	June 11	62·6	50·9	56·8	48·4	75	150·0	24·0	53·03	183	4·9
Auckland	81·5	January 26	38·5	August 12	66·5	54·6	60·6	54 8	82	146·0	30·0	53·81	203	5·9
Jamaica, Kingston..	92·9	July 4	63·8	Mar. 17, Dec.7	86·5	70·6	78·6	69·4	79	...	...	34·29	97	5·3
Trinidad.....	93 0	May 15, 17 Jly.12, Aug.29	61·0	March 9	87·9	68 6	78·3	71·4	81	171·0	57·0	92·49	194	...
Toronto	93·3	July 25	—17·8	January 11	51·0	34·9	42·9	37·4	77	...	—22·0	39·09	198	5·9
New Brunswick, Fredericton. ...	94·7	August 11	—26·0	December 15	49·9	28·3	39·1	32·9	72	...	...	43·59	148	5·1
Manitoba Winnipeg	92·8	June 13	—48·0	February 1	42·1	18·5	30 3	...	...	...	...	23·93	134	5·5
British Columbia, Esquimalt	80·0	June 5	— 1·5	January 31	53·5	41·0	47·2	43·3	87	...	...	51·03	212	6·7

Summary.

Highest Temp. in Shade	108°·0 at Adelaide, on Feb. 2nd.
Lowest „ „	—48°·0 at Winnipeg, on Feb. 1st.
Greatest Range in Year	140°·8 at Winnipeg.
Least „ „	26°·4 at Colombo, Ceylon.
Greatest Mean Daily Range.....	23°·6 at Winnipeg.
Least „ „ „	10°·9 at Mauritius.
Highest Mean Temp.	80°·3 at Colombo, Ceylon.
Lowest „ „	30°·3 at Winnipeg.
Driest Station	Adelaide, mean humidity 60.
Dampest „	Esquimalt, mean humidity 87.
Highest Temperature in Sun ...	171°·0 at Trinidad.
Lowest Temperature on Grass...	—22°·0 at Toronto.*
Greatest Rainfall	92·49 in. at Trinidad.
Least „	19·80 in. at Camden Square.
Most Cloudy Station.....	Esquimalt, average amount 6·7.
Least „ „	Malta... / Bombay „ „ 3·9

REVIEW.

Report on the Epidemic of Enteric Fever in 1893 *in . . . . Worthing . . . .* by C. KELLY, M.D., M.O.H. for West Sussex. Southern Publishing Co., Brighton, 1894. 8vo, 60 pages, and 15 maps and plates.

IN bygone times the Worthing disaster of 1893 would have been regarded as a visitation beyond human control. We now know more ; we know that this disease arises from dirt ; and when human beings realise that cleanliness is of greater importance than politics, this disease will be numbered with the things of the past. Worthing had its water supply fouled, and severe indeed was the penalty. It would be a good thing for the country could Worthing's lesson be brought to the notice of every Borough or County Councillor throughout the land, for Worthing is not the only place where an outbreak of enterics or typhoid fever may occur.

Dr. Kelly has, we think, done most wisely in making this Report perfectly clear and frank. He seems to have concealed nothing, and to have proved his case—the sad one that the fouling of the water (aggravated by warm weather) was the direct cause of 1,416 cases and 188 deaths. Happily, he is able to report the abandonment of the old water works, and the return of the population to an extremely good state of health.

* The Min. on Grass in not recorded at Canadian stations except Toronto.

INJURY TO VEGETATION IN MAY.

To the Editor of the Meteorological Magazine.

SIR,—It is, as another of your correspondents observes, some time since May, yet I venture to think all interest in the injury which many gardens sustained in that month is not yet exhausted.

The greatest cold in May occurred here on the morning of the 21st, when the minimum was 30°·9; this degree of cold would not ordinarily have produced the effects observed, it was, however, the fruit trees that principally suffered, and I believe the cause must be sought in the dryness, and the force of the wind which blew all night, and the rainfall.

The degrees of humidity at 9 a.m. were as here given:—

May 20..... ...	0·70	May 25.....	0 68
,, 21.....	0·65	,, 26.....	0·69
,, 24.....	0·70		

There had been considerable drought for 27 days, from the middle of March to the middle of April, then came about an inch of rain which started the buds again, just before a dry period, from May, 17th to 27th came an inch of rain, and a fresh impulse to the roots, only to cause the tender leaves to feel the full force of the scorching wind and sun. I noticed that potatoes when screened from wind by walls and houses in some instances escaped entirely, while neighbouring gardens had theirs cut to the ground.—Your obedient servant,

JOHN SLATTER.

Whitchurch Rectory, Oxon, 20th Sept., 1894.

WESTMORELAND WEATHER.

To the Editor.

SIR,—Referring to the paragraph in your number of to-day with regard to the fine weather in North Scotland during September, it may interest your readers to learn that similar conditions have prevailed in Westmoreland and the North-West Riding of Yorkshire. On Thursday last I left Westmoreland for London, and the contrast between the bright sunshine there and the chill fog and dampness here is most remarkable.

It is not only a few days of this glorious weather which has prevailed in our mountainous and generally rainy county.

Since August 25th, and over a continuous period of six weeks no rain of any moment has fallen. Days of bright sunshine and summer heat, with cool nights, have been almost uninterrupted.

Taking the rainfall at two places about fifty miles apart, viz., Kendal, in Westmoreland, and Foulridge (near Skipton) in the West Riding, the results are nearly alike during the six weeks, viz.:—At Kendal ·31 in., and at Foulridge ·39 in., whereas in 1893 the rainfall in September at these places was nearly seven inches.

The effect of this fine weather upon land and farming prospects has been very beneficial. The corn crop, which is up to the average, has been housed in a perfectly dry condition, and with much less labour than usual, whilst the after growth of grass and clover, stimulated by rain in August and sunshine in September, has been so luxuriant that the cattle are feeding knee-deep in herbage.

I hear to-day that rain fell yesterday for three hours in Westmoreland, six weeks and one day having elapsed since the last heavy fall.

The Athenæum, London, Oct 8. ALFRED HARRIS.

[*From the Westminster Gazette.*]

[For the Counties
se

Div.	STATI	Aver.	Cloud.
II.	Dorking, Al		5·8
,,	Birchington,		5·6
,,	Hailsham ..		...
,,	Ryde, Thorn		6·0
,,	Emsworth,		2·7
,,	Alton, Ash		1·7
III.	Oxford, Ma		5·9
,,	Banbury, B		3·1
,,	Northampt		4·6
,,	Alconbury ..		4·9
,,	Wisbech, B		4·4
IV.	Southend ..		5·2
,,	Harlow, Sh		4·0
,,	Colchester,		3·6
,,	Rendlesha		...
,,	Diss		5·0
,,	Swaffham .		6·0
V.	Salisbury,		4·0
,,	Bishop's Ca		6·0
,,	Blandford,		
,,	Ashburton,		
,,	Okehampt		
,,	Hartland A		
,,	Lynmouth		
,,	Probus, L		
,,	Wellingto		
,,	Wincanto		
VI.	Clifton, P		
,,	Ross, The		
,,	Wem, Cli		
,,	Cheadle,		
,,	Worceste		
,,	Coventry		
VII.	Ketton H		
,,	Granthan		
,,	Horncast		
,,	Worksop		
VIII.	Neston,		
,,	Lancaste		
,,	Brought		
IX.	Ripon, M		
,,	Scarboro		
,,	East Lay		
,,	Middlet		
X.	Haltwhi		
,,	Bambur		
,,	Keswick		
XI.	Llanfre		
,,	Llandov		
,,	Castle M		
,,	Builth,		

he sea
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rainfall
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SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·10	XI.	Rhayader, Nantgwillt..	1·75
,,	Birchington, Thor	1·83	,,	Lake Vyrnwy	·94
,,	Hailsham	3·27	,,	Corwen, Rhug	1·18
,,	Ryde, Thornbrough	3·98	,,	Carnarvon, Cocksidia ...	·89
,,	Emsworth, Redlands ...	3·18	,,	I. of Man, Douglas	·53
,,	Alton, Ashdell.....	2·71	XII.	Stoneykirk, Ardwell Ho.	·21
III.	Oxford, Magdalen Col...	1·80	,,	New Galloway, Glenlee	·16
,,	Banbury, Bloxham	2·35	,,	Melrose, Abbey Gate ..	·83
,,	Northampton, Sedgebrook	1·37	XIII.	N. Esk Res. [Penicuick]	·45
,,	Alconbury	1·18	,,	Edinburgh, Blacket Pl..	·48
,,	Wisbech, Bank House..	1·29	XIV.	Glasgow, Queen's Park.	·14
IV.	Southend	1·76	XV.	Inverary, Newtown	·11
,,	Harlow, Sheering	1·59	,,	Islay, Gruinart School..	·29
,,	Colchester, Lexden.....	1·20	XVI.	Dollar.....	·08
,,	Rendlesham Hall	·98	,,	Balquhidder, Stronvar..	·21
,,	Diss	·97	,,	Ballinluig	·12
,,	Swaffham	2·06	,,	Dalnaspidal H.R.S. ...	·55
V.	Salisbury, Alderbury...	1·92	XVII.	Keith H.R.S.	2·17
,,	Bishop's Cannings	2·01	,,	Forres H.R.S.	·78
,,	Blandford, Whatcombe.	2·77	XVIII.	Fearn, Lower Pitkerrie.	·29
,,	Ashburton, Holne Vic....	5·05	,,	Loch Shiel, Glenaladale	·40
,,	Okehampton, Oaklands.	2·10	,,	N. Uist. Loch Maddy ...	·46
,,	Hartland Abbey	2·26	,,	Invergarry	·21
,,	Lynmouth, Glenthorne.	2·08	,,	Aviemore H.R.S.	·98
,,	Probus, Lamellyn	2·06	,,	Loch Ness, Drumnadrochit	·60
,,	Wellington, Sunnyside..	2·20	XIX.	Invershin	·07
,,	Wincanton, Stowell Rec.	2·90	,,	Scourie	1·51
VI.	Clifton, Pembroke Road	3·22	,,	Watten H.R.S.	·60
,,	Ross, The Graig	3·78	XX.	Dunmanway, Coolkelure	1·97
,,	Wem, Clive Vicarage ...	·78	,,	Fermoy, Gas Works ...	1·07
,,	Cheadle, The Heath Ho.	·80	,,	Killarney, Woodlawn ...	...
,,	Worcester, Diglis Lock	1·79	,,	Tipperary, Henry Street	·55
,,	Coventry, Coundon	2·70	,,	Limerick, Kilcornan ...	·30
VII.	Ketton Hall [Stamford]	1·15	,,	Ennis	·16
,,	Grantham, Stainby	·75	,,	Miltown Malbay.....	·62
,,	Horncastle, Bucknall ...	1·00	XXI.	Gorey, Courtown House	·83
,,	Worksop, Hodsock Priory	·67	,,	Athlone, Twyford	·17
VIII.	Neston, Hinderton	·76	,,	Mullingar, Belvedere ...	·37
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	·10
,,	Broughton-in-Furness..	·98	XXII.	Galway, Queen's Coll...	·08
IX.	Ripon, Mickley	·63	,,	Crossmolina, Enniscoe..	·77
,,	Scarborough, South Cliff	2·16	,,	Collooney, Markree Obs.	·26
,,	East Layton [Darlington]	·98	,,	Ballinamore, Lawderdale	·29
,,	Middleton, Mickleton..	1·07	XXIII.	Lough Sheelin, Arley ..	·23
X.	Haltwhistle, Unthank..	·83	,,	Warrenpoint	·36
,,	Bamburgh.....	1·28	,,	Seaforde	·35
,,	Keswick, The Beeches...	·69	,,	Belfast, Springfield	·30
XI.	Llanfrechfa Grange	3·41	,,	Bushmills, Dundarave...	·41
,,	Llandovery	1·29	,,	Stewartstown	·14
,,	Castle Malgwyn	1·41	,,	Buncrana	·40
,,	Builth, Abergwessin Vic.	1·66	,,	Lough Swilly, Carrablagh	·77

SEPTEMBER, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32° In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·05	— 1·46	·27	7	11	71·2	1	39·3	29	0	1
II.		Maidstone (Hunton Court)...	2·96	+ ·37	·44	2	13	...	...	...	...	...	...
,,		Strathfield Turgiss	2·42	— ·03	1·04	7	11	70·6	1	32·5	29	0	3
III.		Hitchin	1·77	— ·73	·31	23	15	68·0	1*d*	34·0	28	0	...
,,		Winslow (Addington)	1·77	— ·90	·37	25	10	66·0	2	31·0	29	2	3
IV.		Bury St. Edmunds (Westley)	1·41	— 1·29	·77	25	10	64·0	19	38·0	28	0	...
,,		Norwich (Brundall)	1·68	...	·62	25	16	71·0	19	40·0	11	0	3
V.		Weymouth(LangtonHerring)	4·06	+ 1·64	1·32	22	10	67·0	2, 24	40·0	29	0	...
,,		Torquay (Cary Green)	3·05	...	1·18	21	12	66·6	15	42·5	29	0	0
,,		Polapit Tamar [Launceston]..	2·10	— 1·61	1·12	21	13	71·5	1	38·0	30	0	4
VI.		Stroud (Upfield)	2·51	— ·40	·91	7	10	70·0	2	38·0	27	0	...
,,		ChurchStretton(Woolstaston)	1·45	— 1·05	·67	25	9	65·0	11	37·0	29	0	3
,,		Tenbury (Orleton)	2·51	— ·10	·63	22	11	70·0	11	32·0	28	1	5
VII.		Leicester (Barkby)	1·10	— 1·54	·45	25	12	70·0	2	28 0	27	4	7
,,		Boston	·74	— 2·03	·25	5	11	71·0	1	38·0	27	0	...
,,		Hesley Hall [Tickhill].....	·47	— 1·69	·17	25	9	66·0	1, 14	35·0	28	0	1
VIII.		Manchester(PlymouthGrove)	·98	— 2·49	·62	19	6	68·0	1	30·0	27	4	...
IX.		Wetherby (Ribston Hall) ..	·94	— 1·52	·42	6	8	...	...	...	...	...	...
,,		Skipton (Arncliffe)	·54	— 4·22	·27	5	8	...	...	...	...	...	...
,,		Hull (PearsonPark)	·84	— 1·60	·24	7	10	69·0	11	38·0	27 *i*	0	...
X.		Newcastle (Town Moor)	·83	— 1·95	·20	1	11	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	·59	—11·14	·38	5	3	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·32	— 1·42	·91	23	9	...	...	...	...	...	...
,,		Haverfordwest	1·89	— 2·51	·78	7	7	65·3	3	30·3	30	2	...
,,		Aberystwith (Gogerddan) ...	1·60	— 2·67	1·10	7	8	71·0	20	27·0	29	7	...
,,		Llandudno.....	·64	— 1·58	·25	4	7	63·6	1	38·8	28	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	·20	— 3·36	·14	1	3	69·8	14	29·8	27	2	...
,,		Jedburgh (Sunnyside).....	1·15	— 1·54	·37	1	9	79·0	10	31·0	28	1	...
XIV.		Colmonell	·21	...	·21	1	1	72·0	1,16	26·0	27	4	...
XV.		Lochgilphead (Kilmory).....	·24	— 4·89	·08	25	5	...	...	30·0	27	7	...
,,		Mull (Quinish).....	·14	— 4·89	·11	14	2	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·30	— 2·49	·10	5*a*	3	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·15	— 2·36	·06	25	7	70·9	11	36·2	27	0	...
XVII.		Braemar	·96	— 1·90	·68	4	12	65·1	17	32·2	24	0	1
,,		Aberdeen (Cranford)	·62	...	·14	7	14	...	...	...	...	...	...
XVIII		Strathconan [Beauly]	·43	— 3·25	·20	5	4	...	...	...	...	...	...
,,		Glencarron Lodge.....	·42	...	·08	10*c*	11	65·0	17	34·7	26	0	...
,,		Cawdor [Nairn]	1·08	— 1·67	·28	3	12	...	...	...	...	...	...
XIX.		Dunrobin	·19	— 2·40	·08	6	5	64·0	10	41·0	4	0	...
,,		S. Ronaldsay (Roeberry).....	·42	— 2·24	·10	4	13	58·0	14*e*	44·0	22	0	...
XX.	IRELAND.	Darrynane Abbey.....	1·37	...	·97	7	4	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	1·16	— 1·76	·66	7	5	67·0	10*f*	35·0	10	0	...
,,		O'Briensbridge (Ross)	·32	...	·23	7	2	...	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	·35	— 2·47	·18	7	6	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	·44	— 1·53	·16	7	8	63·9	10	39·8	28	0	0
XXII.		Ballinasloe	·23	— 2·56	·09	1	6	67·0	29*g*	29·0	28	8	...
,,		Clifden (Kylemore)	·31	...	·14	10	4	...	...	...	...	...	...
XXIII		Waringstown	·20	— 2·96	·10	5,24	2	75·0	9	29·0	27	3	7
,,		Londonderry (Creggan Res.).	·50	— 3·28	·33	1	6	...	...	...	...	...	...
,,		*Omagh (Edenfel)*	·17	— 3·21	·08	24	5	64·0	13*h*	26·0	27	3	7

a And 23, 26. *c* And 14. *d* And 2, 18. *e* And 17. *f* And 25. *g* And 30. *h* And 16. *i* And 29.

+Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A fair month with several wet days, but with little R. A sharp TS circulated round this station on 7th, with much R, but did not develop, being heavier to the E. T on 6th. Ivy in flower on 12th. Red admiral butterfly flying on 14th.

ADDINGTON.—A dull, cold month with a most unusual predominance of N.E. winds (twenty-nine days out of thirty). The max. shade temp. 66° is the lowest for the month noted during the last twenty-four years. A lower min. temp. has been registered, but not often. On the 28th and 29th many tender plants were cut off by frost. In September, 1880, the max. temp. was 85°, 19 degrees higher than the max. of this month. Fog on four days. T and H on 6th.

BURY ST. EDMUNDS.—A month of northerly winds, low temp. and little sunshine.

NORWICH, BRUNDALL.—A cool and cloudy month, with light rains and damp mists at times. Mean temp. 3° below the average. L on 8th, T on 27th, H on 28th and 29th.

LANGTON HERRING.—The first week of the month was wet and unsettled, with T and L on the 2nd, 5th, 6th and 7th; then followed thirteen days of fine dry weather, most favourable for the in-gathering of the harvest. From the 20th to the 24th 2·36 in. of R fell; the last six days of the month were bright and sunny. On the whole a fine month but rather cold, the mean temp. being 3°·1 below the average. The mean reading of the bar. was higher than that of any September in the previous thirteen years, and the reading on the 30th was higher than that of any day during that time.

TORQUAY, CARY GREEN.—R ·70 in. above the the average. Mean temp. 56°·3, or 0°·6 below the average. Amount of sunshine 156 hours 5 minutes, being 1 hour 20 minutes below the average; four sunless days.

POLAPIT TAMAR.—Total R less than half the average of thirteen years. The month was specially noticeable for the prevalence of E. wind and the absence of strong winds or gales. Fogs on three days, thick on 19th and 20th.

STROUD, UPFIELD.—T and L on the 4th, TS on 5th, and T on 6th. Fog at night on the 19th. Prevailing winds N. and N.E.

WOOLSTASTON.—A very dry month without much sunshine. The harvest generally well got in. Mean temp. 52°·0.

TENBURY, ORLETON.—A cold and sunless month with about the average quantity of R. With the exception of a few hours on the 7th the wind was N. or N.E. all the month. Sharp frosts on the 28th, 29th and 30th. Fog on 7 days. TS on 4th.

LEICESTER, BARKBY.—Warm nights till 26th. Mean temp. of the month 52°·4. Great scarcity of water. T on 5th.

MANCHESTER, PLYMOUTH GROVE.—The driest September experienced since observation commenced twenty-seven years ago, and, with the two exceptions of 1871 and 1878, when the mean temp. was 52°·6 each year, the coldest September during that time. Mean temp. 52°·9.

WALES.

HAVERFORDWEST.—During the first twelve days six cold nights occurred, and from 25th to 30th the nights were cold and frosty, but the bulk of the nights were above the average for the month. The weather was splendidly fine; the day temp. below the mean, with air crisp; prevailing winds N.N.E.; much bright sunshine; many nights very foggy; small rainfall. One of the finest harvest months on record; 23 days without R.

ABERYSTWITH, GOGERDDAN.—Very fine throughout the month with bright sunshine.

SCOTLAND.

CARGEN.—A remarkably fine month, with mean temp. one degree above the average. Mean bar. pressure 30·150 in.; on only four occasions during the last 34 years has this mean pressure been exceeded, viz., November, 1867, January, 1880, June, 1887, and February, 1891. On only one occasion since observations were commenced has there been a less fall of R in any one month, viz., April, 1873, when ·10 in. fell. The total R from August 15th to the end of September was only ·40 in. E. winds prevailed for 24 days, and were remarkably light.

JEDBURGH.—The month was marked by generally cold ungenial weather for the season. The R was slight and fell at long intervals, allowing much corn to be saved, but frosts and dew prevailed a good deal, which retarded operations generally till mid-day. The cereal crops are above the average; the turnip crop rather disappointing.

COLMONELL.—The least rainfall in any September from 1876–94, and, in fact, the least in any month in these years.

MULL, QUINISH.—An unprecedented month of sunshine and dry weather. The harvest in this district has been got in under most unusual conditions.

BRAEMAR.—A fine, dry month. Duration of sunshine 107 hours 45 minutes.

ABERDEEN, CRANFORD.—An exceptionally fine month. All grain crops cut and stacked in good order.

DUNROBIN.—The finest and driest September for at least a quarter of a century.

ROEBERRY.—Very dry and quiet throughout. The driest September recorded for 28 years.

IRELAND.

DARRYNANE ABBEY.—A very dry and fine, sunny month, the number of days with R being the smallest registered. The next smallest were seven days in May, 1876, and nine days in November, 1879, the corresponding falls being ·83 in. and ·75 in. The falls in May, 1874 (1·20 in.), March and April, 1893 (1·02 and 1·26 in.), were less than this month, but on more days (17, 13, 10). The first part of the month was very warm, but the last few days were rather cold.

O'BRIENSBRIDGE, ROSS.—The driest and most beautiful month in this record of 49 years. September, 1888, being the nearest to it, but with many more rainy days.

DUBLIN.—As in 1893, so in 1894, September proved a favourable month throughout; quiet, cool weather, with an overwhelming prevalence of N. to E. winds, and a very scanty and infrequent rainfall. The mean temp. (53°·8) was exactly 2° below the average. High winds were noted on only two days. L on the 4th. Fog on 5 days.

WARINGSTOWN.—The driest month ever recorded here. Sharp frost on the 27th, earlier than usual by a fortnight or three weeks.

EDENFEL.—The drought which set in on the 27th August, and embracing the whole month of September, has now (6th October) reached its forty-first day, during which time but ·19 in. of R has fallen on seven days. This is by far the driest period of like duration recorded here in 30 years, and as far as I am able to ascertain from some records in my possession and the "oldest inhabitants," for at least as far back as 1826. A high and steady bar., averaging about 30·3 in.; winds, if any, from northerly or easterly points, and a smaller proportion of clear sunshine than is common to these conditions has accompanied them. A good harvest has been secured even in the mountain districts in perfect order.

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Rainfall on Mount Lebanon
Storm of September 20th, 1894,
Anemone Hailstones ...
The Recent Drought in the Mid
Lunar Rainbow ... ...
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OVEMBER, 1894.

ON: EDWARD STANFORD,
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A Monthly Review of Astronomy.

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T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

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SYMONS'S
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CCCXLVI.] NOVEMBER, 1894. [PRICE FOURPENCE, or 5s. per ann. post free.

RAINFALL IN JERUSALEM.*

AMONG our old MSS. we have the portion of the following table preceding 1856. In Beardmore's *Manual of Hydrology*, 1862, p. 361, the table is carried on to the end of 1859, and as it is evidently the same record, we have incorporated the two† :—

Rainfall at Jerusalem.

Observer - - - DR. MACGOWAN.

Altitude { Above the Mediterranean..... 2,749 ft.
,, ,, Dead Sea ..... 4,116 ,,

Year.	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.	6·0	9·8	24·6	19·4		14·6	13·6	4·2	13·2	32·6	17·6	13·0	23·2	11·2
Feb.	7·4	32·8	5·8	13·2		24·0	25·0	4·0	20·0	13·0	21·8	57·2	23·6	8·2
March	5·4	6·0	·0	11·8		4·0	8·8	21·4	24·2	8·8	10·2	4·0	1·6	16·8
April	·0	·0	·2	·0		2·2	·0	1·2	10·8	2·4	24·8	4·0	5·2	6·2
May	·0	·0	1·4	·0		·0	2·4	2·0	·0	·0	·6	1·0	·0	·0
June	·0	·0	·0			·0	·0	·0	·0	·0	·0	·0	·0	·4
July	·0	·0	·0			·0	·0	·0	·0	·0	·0	·0	·0	·0
Aug.	·0	·0	·0			·0	·0	·0	·0	·0	·0	·0	·0	·0
Sept.	·0	·0	·0			·0	·0	·0	·0	·0	·0	·0	·0	·0
Oct.	4·0	·0	·0		·0	·0	·0	·0	3·8	·0	·0	1·4	·0	4·4
Nov.	6·4	·0	·2		6·4	·0	1·8	6·0	·0	1·0	14·8	6·6	·0	2·8
Dec.	·0	19·0	16·0		33·8	15·2	9·4	12·4	6·4	3·2	4·2	17·0	21·8	·8
Totals	29·2	67·6	48·2			60·0	61·0	51·2	78·4	61·0	94·0	104·2	75·4	50·8

Not observed. Not observed.

Mean for the years 1846–1848 & 1851–59=65·1 in.

Beardmore's table was reprinted (with the mistakes) in Dr. J. I. Whitty's *Proposed Water Supply for Jerusalem*, 1863, p. 194.

For subsequent (and very different) information there are two principal sources, both based upon one series of observations, but each throwing some little light upon the details furnished by the

* On the Fall of Rain at Jerusalem in the 32 years from 1861 to 1892, by J. Glaisher, F.R.S., *Quarterly Statement of the Palestine Exploration Fund*, January, 1894.

† In Beardmore's table the addition is wrong for 1853, the true total being 51·2 in. ; and in 1854 March is given as 24·8 in., instead of 24·2 in., which we believe was the value actually recorded.

other. The sources are (1) several papers by Dr. Buchan, F.R.S.E., and by Dr. Chaplin, published in the *Journal of the Scottish Meteorological Society* in 1867 and subsequent years; and (2) the very valuable paper by Mr. Glaisher, already referred to.

It is rather strange that neither Dr. Buchan nor Mr. Glaisher makes any reference to the early observations. However, we had better reprint the only scraps of information which we possess.

First: Dr. Buchan, *Jour. Scot. Met. Soc.*, 1869, p. 98 :—

> "While on a tour through Palestine in the spring of 1863, Dr. Keith Johnston, the Society's Honorary Secretary, made arrangements with Dr. Thomas Chaplin for making Meteorological Observations at Jerusalem. The Board of Trade most cordially co-operated with the Society in the supply of instruments."

And again on p. 104 :—

> "As the (rainfall) observations began in November, 1863, we cannot go further back than the 1st of the month."

Mr. Glaisher's account, *Quarterly Statement*, Jan., 1894, p. 39, is equally definite :—

> "The series of daily observations of rain was begun by Dr. Chaplin in the year 1861, and was continued by him for the long period of 22 years till the end of 1882 : they have since 1883 been continued under the auspices of the Palestine Exploration Fund.
>
> "The rain gauge used during the first six years was a float gauge by Newman, and since then a certified 8-inch gauge by Negretti and Zambra. During four years the gauges were placed side by side ; the float gauge registered during these four years 88·83 inches, and Negretti and Zambra's gauge 93·25 inches, and the readings by Newman's gauge have been corrected so as to give results in accordance with the 8-inch gauge.
>
> "Dr. Chaplin says that the position of the gauges was in a garden within the city, about 2,500 feet above the level of the Mediterranean, open on all sides, the houses which bound it on the S. and W. being too far removed to influence the fall of rain on the pluviometer."

Now let us try to get at the actual facts.

It would have been more frank had Dr. Keith Johnston recognized the earlier work of Dr. Chaplin, but it is evident that what really happened in the spring of 1863 was that Dr. Keith Johnston found Dr. Chaplin working with a Newman rain gauge (and probably indifferent thermometers, &c., but we are not dealing with them), thought it desirable that he should have a good one, obtained a verified Glaisher gauge from Admiral FitzRoy, which arrived in Jerusalem in time to be brought into use on November 1st, 1863.

Thus completed, Dr. Buchan's statement agrees with Mr. Glaisher's, that the gauges used were—

Newman's	1861,	1862,	1863,	1864,	1865,	1866
Negretti's			1863,	1864,	1865,	1866 and onwards.

But in the next place we cannot make Mr. Glaisher's statement correspond with his own table. He says that during the first six years a Newman gauge was used, and that during four years the two gauges were side by side. It is reasonable to assume that this comparison began when the second gauge arrived, viz., in November, 1863, but neither by taking the whole of 1863 and three subsequent years, nor by any combination near that date, can we get from Mr. Glaisher's own table 48 consecutive months giving the total of 93·25 inches mentioned in the extract above quoted.* The matter is probably not important, but it lessens the confidence which otherwise we should have felt in the whole table, which we have not space to reproduce *in extenso*. We therefore give abstracts—

Total Annual Rainfall at Jerusalem.

	in.		in.		in.		in.
1861	27·30	1871	23·57	1881	16·50	1891	34·72
1862	21·86	1872	20·26	1882	26·72	1892	31·23
1863	26·54	1873	22·72	1883	31·92		
1864	15·51	1874	29·75	1884	23·96	Mean for 32 years = 25·23 in.	
1865	18·19	1875	27·01	1885	29·47		
1866	18·55	1876	14·41	1886	31·69		
1867	29·42	1877	26·00	1887	29·81		
1868	29·10	1878	32·21	1888	37·79		
1869	18·61	1879	18·04	1889	13·56		
1870	13·39	1880	32·11	1890	35·51		
Mean	21·85	Mean	24·61	Mean	27·69		

	Amount in.	%
Max. 1888	37·79	150
Min. 1870	13·39	53

Monthly Rainfall at Jerusalem.

Months.	Depth.					No. of Days.				
	Average.	Greatest.	Date.	Least.	Date.	Aver.	Greatest.		Least.	
	in.	in.		in.						
January	6·38	13·39	1878	·13	1873	12	19	1883, 1885	3,	1881
Feb	5·06	12·59	1882	·69	1870	10	18	1868, 1884	1,	1870
March	3·56	10·52	1875	·42	1865	8	20	1874	2,	1892
April	1·71	6·52	1885	·13	1874	5	13	1868, 1870	1,	1861
May	·27	1·25	1887	·00	11 yrs.	2	5	1867, 1886, 1892	0,	11 yrs.
June	·01	·20	1888	·00	30 yrs.	0	1	1885, 1888	0,	30 yrs.
July	·00	·00	32 yrs.	·00	32 yrs.	0	0	32 yrs.	0,	32 yrs.
August	·00	·08	1890	·00	31 yrs.	0	1	1890	0,	31 yrs.
Sept.	·04	·79	1878	·00	27 yrs.	0	2	1864, 1878	0,	27 yrs.
October	·41	2·29	1870	·00	13 yrs.	2	7	1863	0,	13 yrs.
Nov.	2·29	7·99	1888	·01	1870	6	13	1888	1,	5 yrs.
Dec.	5·50	16·40	1888	·49	1876	10	17	1890	2,	1884
Total	25·23	16·40	1888	·00	124 times	55	73	1890	36,	1864

* We can get a total of 93·25 in. by taking 4¼ years from April, 1864; but if so, the Newman gauge must have been in use for nearly 8 years instead of 6 as stated.

We may add that for 16 out of the 32 years quoted by Mr. Glaisher, we have three independent copies of the record; and for 27 years out of the 32 we have two copies. There are a few differences, but, on the whole, we believe that Mr. Glaisher's values are the best, and that there is no error of more than a few hundredths of an inch in any of the means.

It is obvious that the records for the period 1846-59 and for 1861-92 cannot both be correct; the former gives a mean of 65·1 inches, the latter of only 25·2 inches. There can, we think, be little doubt that the recent observations must be regarded as correct, and those between 1846 and 1859 as erroneous, but it is not easy to understand how so great an error was produced, except upon one hypothesis, for which there is not an atom of evidence except that it would harmonize the two records. The hypothesis is that Dr. Macgowan took out with him an 8-inch gauge, that the measure was broken in transit, and one adapted for a 5-inch gauge was then sent out and used. In that case all his amounts would be too large in the ratio of 2·56 to 1; corrected for that his totals would be—

	in.		in.	
1846	11·4	1854	30·6	
1847	26·4	1855	23·8	
1848	18·8	1856	36·8	
1851	23·4	1857	40·7	Mean = 25·4 in.
1852	23·8	1858	29·5	
1853	20·0	1859	19·9	

This result of 25·4 in. as the mean of one set of observations, and of 25·2 in. as the mean of the others, is a curious coincidence, if it is nothing more. And there is another fact which almost makes it probable that this is really the solution of the mystery.

If the old records were bad from leakage, from malicious interference, or from misplaced decimals, they would, when worked up for monthly means, give anomalous values, but the following table shows that generally the monthly percentages from the two series run very closely together:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Old Series ...	23	30	14	7	1	0	0	0	0	2	5	18
New Series ..	25	20	14	7	1	0	0	0	0	2	9	22

It may have occurred to some one that the Newman gauge which Dr. Chaplin used from 1861 to 1866 was the one which had been used from 1846 to 1859 by Dr. Macgowan, but that seems impossible, because the comparison made by Mr. Glaisher showed that the Newman gauge recorded 5% too little, whereas the record by Dr. Macgowan seems about 156% too great.

On the whole we are satisfied that the true mean rainfall at Jerusalem is 25 inches, almost identical in total with that in London, but that no rain falls between May and October, and that about a fourth of the yearly total falls in each of the three months, December, January, and February.

RAINFALL ON MOUNT LEBANON.

In connection with the above article, it will be of interest to give the monthly totals of the fall of rain as communicated to us by Mr. T. Little, of Ain Salaam, Brumana, Mount Lebanon (a few miles inland from Beyrout), in Lat. 33° 54′ N., and Lon. 35° 35′ E.; the gauge being 8 inches in diameter, 1 ft. above ground, and 2,350 ft. above the level of the sea. Mr. Little says that the rainfall of November and December, 1890, was quite exceptionally heavy, and amounted to that of an average year.

	Jan. in.	Feb. in.	Mar. in.	Apr. in.	May. in.	June. in.	July. in.	Aug. in.	Sept. in.	Oct. in.	Nov. in.	Dec. in.	Total. in.
1890...	7·73	9·64	3·06	2·08	·00	·00	·00	·04	·10	·13	16·11	15·48	...54·37
1891...	10·75	8·53	2·71	2·83	2·34	·00	·00	·00	·78	1·82	4·74	10·95	...45·45

STORM OF SEPTEMBER 20TH, 1894, AT MARTINIQUE.

We have been favoured by M. Leon Sully, of St. Pierre, Martinique, with a long letter dated October 8th, and with photographs of the record of his Richard barograph, and of maps of the track of the storm.

Instead of translating the whole letter we shall state the principal points mentioned. For Martinique M. Sully quotes his own observations; for Guadaloupe those at the Meteorological Office at Pointe à Pitre, and for other localities mostly the local newspapers.

The track of the centre seems to have been over the N. of Dominica, ravaging on its dangerous side, Marie Galante, la Guadaloupe, Montserrat, Antigua, St. Kitt's and Ste. Croix, passing away towards Cuba and Florida.

On the 20th the line perpendicular to that of the propagation of the storm passed St. Pierre, Martinique, at 0.30 p.m., the pressure being 29·69 in., and it passed Pointe à Pitre, Guadaloupe, at 2 p.m. on the same day, pressure 29·77 in. On the 21st it passed Porto Rico, and reached St. Domingo in the night 21st-22nd, in fact it raged furiously from 11 p.m. on 21st to 5 a.m. on 22nd, pressure fell to 29·06 in. It reached Cuba on 24th, and destroyed most of the telegraph lines, and finally passed into Florida near Key West.

M. Sully considers the velocity of translation to have been unusually high for the district, viz., 19½ miles per hour.

One remarkable characteristic of the storm was the absence of electrical phenomena; there was a slight thunderstorm in the night 19th-20th, but in the afternoon of the 20th, when the cyclone was at its height, there was neither ordinary nor globular lightning, and there was no thunder. Perhaps, if it had been night when the storm passed, instead of day, there might have been seen, as on August 18th, 1891, manifestations of St. Elmo's fire.

Although at Martinique the damage was limited to the carrying away of a few blinds and roofs, and of most of the crop of bananas,

it was very different in the islands on the dangerous side of the storm—Dominica, Marie Galante, Guadaloupe, Antigua and Montserrat, where all the plantations have suffered greatly, four-fifths of the houses have been unroofed, and most of the telegraph lines destroyed.

Porto Rico seems to have escaped lightly, but we are told that in St. Domingo 500 houses and two churches were destroyed, nearly all the roofs, even of the Palace and public buildings, were carried away, and the crops levelled.

As regards Cuba and Florida, there has been such damage to the telegraphs, that we have as yet no details.

The letter is accompanied by transcripts of the observations made each half hour by M. Sully, and by a few made at irregular intervals at Pointe à Pitre, Guadaloupe.

THE SAME STORM IN SOUTH EASTERN MEXICO.

We are glad to be able to add to the foregoing a statement from the N.W. of Yucatan, which we have translated from the Summary for September, 1894, issued by the Central Meteorological Observatory of Mexico.

"*Cyclone* [*in the Island of Cuba*].—Sr. Félix Gómez, Engineer of Mérida, Yucatan, has sent us the following note :—

"On Saturday, September 22nd, at 4.40 p.m., we observed in the N.E. many scattered clouds of a cumulo nimbus type coming rapidly at a low altitude. This was the first indication which led me to surmise that a storm existed in the S.E., and I immediately began to watch the wind and the barometer ; the wind was E.N.E., and the mean pressure for the day was 29·93 in.

"On Sunday, 23rd, the sky was occasionally overcast, there were light northerly squalls ; the vane pointed steadily to E.N.E. until the afternoon, when it went to N.N.E., and the pressure fell to 29·92 in.

"On Monday, 24th, the sky continued overcast at intervals ; there were light squalls ; the vane kept at N.N.E. until the afternoon, when it went to N.N.W., and the pressure fell to 29·87 in.

"On Tuesday, 25th, the wind was variable between N.W. and W.N.W., and the sky clear; the barometer fell to 29·84 in., and in the afternoon the wind backed to W.S.W.

"On Wednesday, 26th, the wind went round to S.W., and the barometer rose to 29·86 in., and a drizzle gave 0·05 in. of rain.

"Though the indications of the barometer were very slight, the aspect of the sky and the backing of the wind showed that Mérida was on the western skirt of a cyclone, wherefore we reported to the observatory on the 23rd and subsequent days that a depression existed to our east.

"Notices (received October 1st) from Habana confirm this by stating that a destructive hurricane passed over Cuba on September 23rd and 24th."

ENORMOUS HAILSTONES.

With reference to the article on the above subject on p. 134 of our last number we give the following notes, the first arrived too late to be quoted with the other details of the Richmond storm on p. [20] of *British Rainfall*, 1893.

Richmond, Yorks.—On 8th July a very remarkable hailstorm took place; almost all the hailstones were over an inch in diameter, numbers 2 in. and 2½ in., and one measured 7 in. long by 4½ in. broad. The storm lasted a very short time, about a quarter of an hour, and was very partial, four miles distant there was none; it was vary narrow, and swept over Richmond, and up the valley of the Swale. ELLEN DAVIDSON.

In the *Indian Engineer* for May 19th, 1894, there are engravings of a hailstone which fell at Kanchrapara* at 5.45 p.m. on April 27th, 1873, which was very much of the form of a potato, 3½ in. × 3¼ × 2½, and therefore would weigh about 1 lb. 1 oz. The account says that stones of this size were innumerable, and that those that fell on hard roads bounded about like white cricket balls, and in their rebound rose fully 10 ft. It also states (what is obvious from the dimensions) that they would not go into an ordinary tumbler, and that even at dinner time (?) they had not melted sufficiently to go to the bottom of one. This account is authenticated by five signatures.

During a severe hailstorm at Vicksburg on the afternoon of Friday, May 11th, 1894, a remarkably large hailstone was found to have a solid nucleus, consisting of a piece of alabaster from one-half to three-quarters of an inch [? in length]. During the same storm at Bovina, eight miles E. of Vicksburg, a gopher turtle, 6 by 8 in., and entirely encased in ice, fell with the hail.

An examination of the weather map shows that these hail storms occurred on the S. side of a region of cold northerly winds, and were but a small portion of a series of similar storms; apparently some special local whirls or gusts carried heavy objects from the earth's surface up to the cloud region, where they were encased by successive layers of snow and ice, until they fell as hailstones. The fact that hailstones, as well as drops of water and flakes of snow, often contain nuclei that must have been carried up from the earth's surface, is entirely in accord with the general principle that ascending currents precede the formation of cloud and rain, and that solid nuclei are needed to initiate the ordinary precipitation of moisture.—Prof. CLEVELAND ABBE, in the U.S.A. *Monthly Weather Review*, May, 1894, p. 215.

From Mr. S. M. Blandford, temporarily in charge of the Weather Bureau office in Portland, Oregon, there was received too late for the

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* This is a little above Hooghly, or Hugli, about 30 miles N. of Calcutta, and in Lat. 22° 58′ N., Lon. 88° 27′ E.

June Review a report of the tornado which occurred June 3rd, 1894, passing northeastward through the counties of Harney, Grant and Union, in eastern Oregon. He says that the most novel feature was the hail. Our correspondent states that the formation was more in the nature of sheets of ice than simple hailstones. The sheets of ice averaged 3 to 4 in. square, and from three-fourths of an inch to 1½ in. in thickness. They had a smooth surface, and in falling gave the impression of a vast field or sheet of ice suspended in the atmosphere, and suddenly broken into fragments about the size of the palm of the hand. During the progress of the tornado at Long Creek, a piano was taken up and carried about a hundred yards.—U.S.A. *Monthly Weather Review*, July, 1894, p. 293.

THE RECENT DROUGHT IN THE MIDLANDS.

To the Editor of the Meteorological Magazine.

SIR,—I have only glanced at the *Met. Mag.* just arrived, but read your remarks about our rainfall. With all due deference to your figures and remarks, we, living here, seem to think that you have omitted one very serious consideration.

You take the Barkby fall. On comparing my rainfall here with that, we certainly have not been blessed with so much. But, omitting this, you seem to take no notice of the *actual amount of each fall.* If the ground is dry, a small fall (as far as the Reservoir is concerned) will do no good. Now, taking from October last year up to the present time, we have had but *one* fall over ·70 in., and that was in February, and was snow. In fact, that was the only snow we had all the winter. Then we have had but *one* fall over ·60 in. (in June); *none others over half-an-inch.* By examining the annexed table, you will see that out of the 174 days on which rain or dew fell, no fewer than 118 produced less than ·10 in. each time. The *total* amount appears good, but when it comes in such driblets, it cannot run into the Reservoir. The dry mud all round the water has large cracks, which swallow up all small contributions, and it is only a heavy rain which will do much good, and this we have not had. Again, though our rainfall appears to be respectable, it has come in such a manner as to be practically of little value (as far as the Reservoir is concerned). Taking a few examples:—On December 20th we had ·33 in. of sleet; the next "heavy" fall was on January 17th, when ·10 in. fell; the total fall for the intervening 28 *days was only* ·55 *in.* The next "heavy" fall was on February 16th, when ·17 in. fell; the total fall for the intervening 29 days was ·59 in. Thus, during 59 days of the three winter months, we had only 1·38 in. March 13th, ·15 in., not a drop for the next 20 days; then on April 3rd we had ·31 in. June 15th, ·30 in.; July 10th, ·38 in.; for the intervening 24 days only ·22 in. August 25th, ·48 in.; September 25th, ·32 in.; for the intervening 30 days only ·41 in. Since September 25th up to the present time, an interval of 23 days, we have had but ·25 in.

Amount of Rain per diem at Thurcaston.

		Under ·10 in.	·10 to ·20 ,,	·20 ,, ·30 ,,	·30 ,, ·40 ,,	·40 ,, ·50 ,,	·50 ,, ·60 ,,	·60 ,, ·70 ,,	·70 ,, ·80 ,,	Total Days.
		days.	days.	days.	days.	days.	days.	days.	days.	
1893	October.	6	2	2	1	1	—	—	—	12
	Nov. ...	9	1	2	2	—	—	—	—	14
	Dec.....	15	—	1	2	—	—	—	—	18
1894	January.	19	1	—	—	—	—	—	—	20
	Feb.....	12	3	—	—	—	—	—	1	16
	March...	8	2	—	—	—	—	—	—	10
	April.. ..	7	4	—	2	—	—	—	—	13
	May.....	11	1	3	—	1	—	—	—	16
	June	5	3	1	1	—	—	1	—	11
	July.....	10	2	2	3	—	—	—	—	17
	August..	10	3	3	1	1	—	—	—	18
	Sept.....	6	2	—	1	—	—	—	—	9
		118	24	14	13	3	—	1	1	174

Yours very sincerely,

T. A. PRESTON.

Thurcaston Rectory, Leicester, October 17th, 1894.

[Mr. Preston's letters are generally so interesting that one regrets their rarity—but this time we really must say a few words in our own defence—not because he disproves one word that we wrote, but because the opening sentence implies that he contemplated doing so.

He seems not to admire our taking the Barkby record, but it was essential to take a long one—and the Thurcaston record does not go back 10 years, whereas the Barkby one goes back a quarter of a century.

In the second paragraph he goes carefully (and we agree with him), into *one* of the reasons for the water trouble at Leicester, but if he will look at p. 133 he will find that we wrote "we are not here discussing why Leicester is short of water, but whether there has been in the Midland Counties anything like the drought which we had in the South of England in 1893," and we found no evidence of such a drought.

Mr. Preston gives away his case by saying "The *total* amount appears good," and the addition, "but when it comes in such driblets it cannot run into the Reservoir" opens the very question which we had excluded, because the subject of the water supply of Leicester would be foreign to the province of the *Meteorological Magazine*.

The facts shown by Mr. Preston's table are decidedly important, and we are glad that it is put upon record that at a station with a mean annual rainfall of about 28 inches, it is possible to have 12 consecutive months with no fall exceeding 0·80 in. and only two exceeding half-an-inch.—ED.]

LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—A perfect lunar rainbow was visible here on October 15th, at 6.15 p.m. The moon had just risen over a heavy cloud bank, and threw a primary bow on a retreating shower. The colours were very distinct, but not so bright as in a sun bow. The legs subtended an angle of 75°, and one leg was visible between me and a house 200 yards distant, it appeared to be less than half that distance; the other leg could not be traced to the ground.

J. P. MACLEAR.

Cranleigh, Surrey.

ON COLD BEFORE AND AFTER THE NEW YEAR.

To the Editor of the Meteorological Magazine.

SIR,—How is cold before the New Year related to that after it? If we have a great deal of cold in the end of the year, are we likely to be compensated by mildness in the early months of the next year, or is it the opposite?

I have recently sought an answer to this in the number of frost days at Greenwich in the 53 winter seasons 1841–2 to 1893–4 (not considering intensity of frost), and the following analysis may be found interesting.

The average number of frost days in the fourth *quarter* (October to December) in those years is 18 (exactly, 17·9), with a variation from 2 to 38. On the other hand, the average number in the first *third of the year* (January to April) is 37 (37·2), or just about double, with a variation from 13 to 67.

Considering now the fourth quarter with reference to its average, there were in those 53 seasons—

24 cases above average.
26 ,, below ,,
3 ,, average.

The 24 cases above average were followed by first thirds thus—

16 above average.
7 below ,,
1 average.

The 26 cases below average were followed by first thirds thus—

19 below average.
6 above ,,
1 average.

The 3 average fourth quarters were followed, 2 by first thirds above average, and one by a first third below average. From this it appears that an excess of frost days in the last quarter is more likely to be followed by excess of frost days in the first third, and a deficiency in the former case by a deficiency in the latter.

Here is another analysis, with similar results :—

Suppose we form three groups of the fourth quarters, viz. : (*a*) one containing all cases of 12 frost days or less (13 cases); (*b*) one with

all cases over 12 to 20 (20 cases); (*c*) one with all cases over 20 (20 cases). Then—

The cases of group (*a*) were followed by first thirds whose numbers yield the average	33·3
The cases of group (*b*), &c.	36·4
The cases of group (*c*), &c.	40·5

These facts seem to agree with the "wise saw," "An early winter, a surly winter."—Yours faithfully, A. B. M.

WHIRLWINDS OR SQUALLS ON OCTOBER 24TH & 26TH.

WALPOLE ST. PETER, KING'S LYNN, NORFOLK.—A phenomenon was witnessed in the Marshland District on October 24th. A storm of a severe nature broke over the district about 3.30 p.m. Mr. R. A. Wilkin, solicitor, of King's Lynn, had been attending an inquest at Walpole St. Peter, and on his way home encountered a whirlwind. The carriage in which he was riding was overthrown into the dyke by the side of the road. The vehicle was so fixed in the dyke that Mr. Wilkin had to get out of the window and was somewhat cut and upset by the shock. The driver was found under the horse's feet; he was kicked, but not seriously. The wind uprooted several trees on Mr. Neep's land and a straw stack was blown over. On Mr. John Boon's land adjacent, seven barley and wheat stacks were scattered all over the neighbourhood, and between twenty and thirty men had been employed to gather up and re-stack the corn. The produce on a number of allotments was so mixed up that great difficulty was experienced by the several allotment-holders in identifying their property. Although confined in a limited area the whirlwind did considerable damage.—*Spalding Guardian.*

STRETTON RECTORY, OAKHAM, RUTLAND.—SIR,—You may think it worth while to insert the following account of an unusual hurricane which passed over this village on the evening of Friday, October 26th. It had been blowing somewhat hard all the afternoon, but about 7.30 p.m. there came a sudden rush of wind, which can best be described as the roar of an express train. Its course was, speaking roughly, from S. to N., and it only lasted some three or four minutes. The effects, however, were most extraordinary. It passed through a stackyard in the village, stripping the thatch off one rick, and leaving the rest undisturbed, thus showing that the hurricane was confined to a narrow limit. It next seized upon the roof of a shed on the premises belonging to Mr. Hart. The roof was composed of sheets of corrugated iron, fastened to strong joists, with a heavy oak post resting on the top of it, to make it more secure. The wind lifted up the whole roof. The joists were dropped on the far side of a wall, which formed the back of the shed. The oak post fell in the adjoining paddock about 100 yards from where it had been placed. Of the sheets of iron, one is now resting in the branches of a tree close by, the remainder were dropped at various intervals on each side of the road leading to Stocken, while that which took the longest flight of all, was found in the grounds near Stocken Hall, having made an aerial voyage of quite 1¾ miles. In addition to this, many trees have been either uprooted or have had their tops wrenched off. This, however, has often occurred before, but I doubt whether such an occurrence as that which I have described as happening to the shed, has ever been heard of in this country. How far the gale extended, I know not. I am only describing what came under my own observation.—Yours faithfully, T. O. HALL.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1894.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	71·5	15	33·0	21	61·0	42·4	43·0	77	116·9	25·0	1·85	16	5·9
Malta	77·5	28	51·7	3	71·8	58·5	57·2	75	142·2	46·3	·02	1	5·1
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	80·3	5	58·8	28	77·0	66·6	64·0	79	125·3	48·7	4·41	16	5·9
Calcutta	105·1	17	71·6	11	95·5	79·7	78·2	75	157·0	68·9	3·00	5	3·3
Bombay	92·5	31	79·3	2	90·9	81·1	75·0	71	141·0	73·7	·00	0	2·2
Ceylon, Colombo	89·2	4	75·2	19	87·4	79·3	73·8	77	152·0	72·7	3·00	18	4·3
Melbourne	68·9	16	37·2	27	60·1	45·9	46·8	79	117·5	30·8	1·63	10	6·5
Adelaide	70·5	11	41·5	2	64·1	48·1	47·2	74	132·0	33·6	1·66	14	5·8
Sydney	68·7	1	43·7	31	63·1	50·2	48·6	84	115·0	32·5	1·62	13	3·2
Wellington	63·3	15	38·0	21	59·6	48·2	45·6	74	110·0	25·0	4·33	17	4·8
Auckland	67·0	1*a*	43·5	31	62·7	51·1	49·8	77	130·0	41·0	5·80	22	7·1
Jamaica, Kingston	89·3	26	69·4	3, 5	85·3	72·4	71·1	80	...	...	10·65	12	6·2
Grenada	88·0	11*b*	72·4	17	84·9	74·9	68·9	79	152·0	...	1·99	13	3·5
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	75·6	1	35·1	29	61·6	43·4	43·8	73	...	29·0	9·37	21	6·0
New Brunswick, Fredericton	80·9	2	31·3	14	63·2	40·8	43·4	69	...	...	·90	9	7·0
Manitoba, Winnipeg	80·8	31	28·6	27	65·8	40·2	...	...	...	...	·58	7	6·0
British Columbia, Esquimalt	81·7	25	33·7	9	59·0	44·1	46·4	85	...	...	2·71	19	7·0

a And 3, 4. *b* And 15.

REMARKS.

MALTA.—Adopted mean temp. 64°·2; mean hourly velocity of wind 11·0 miles; cloud 1·6 above average. Thunderstorm on 7th. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·3 below, of dew point 0°·2 below, and rainfall ·36 in. above, their respective averages. Mean hourly velocity of wind 7·9 miles, or 1·9 miles below average; prevailing direction, S.E. to E.S.E. T and L on 15th and 24th, and T on 16th, 21st, and 25th. C. MELDRUM, F.R.S.

Melbourne.—Dense fog on the 9th and 19th. Lunar halos on the 15th and 17th. L on the 16th and 30th. T and L on 17th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 56°·1, or 1°·6 below the average of 37 years. Rainfall over the southern parts of the Colony fair, and well distributed over the month, but only scanty rains over the more northern portions. C. TODD, F.R.S.

Sydney.—Temperature 1°·8 below, humidity 9·4 above, and rainfall 3·58 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Light showers during the early part of the month; wind N.W., and strong on 3rd and 4th; fine during the middle; strong N.W. wind on 21st, 22nd, and 23rd, with rain, and showery for the remainder of the month, and strong S.W. gale from night of 28th to end. Mean temperature 1°·9 above, and rainfall ·65 in. below, the average. R. B. GORE.

Auckland.—A rainy and showery month, only nine days being quite free from rain, with an exceptional fall of 1·54 in. on the 16th. Mean temperature below the average. Rainfall much above, and the highest in the month since 1883. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 4·2 miles. Heavy "seasons" all over the island, the means being 79 per cent. over the average. One station had four, six stations had three times its average fall. Six stations had over 30, and 23 stations had between 20 and 25 inches of rain. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	5·50	XI.	Rhayader, Nantgwillt..	7·73
,,	Birchington, Thor	3·28	,,	Lake Vyrnwy	7·50
,,	Hailsham	4·35	,,	Corwen, Rhug	3·33
,,	Ryde, Thornbrough	4·92	,,	Carnarvon, Cocksidia ...	5·88
,,	Emsworth, Redlands ...	5·48	,,	I. of Man, Douglas	6·34
,,	Alton, Ashdell.....	5·07	XII.	Stoneykirk, Ardwell Ho.	4·66
III.	Oxford, Magdalen Col...	3·26	,,	New Galloway, Glenlee	6·33
,,	Banbury, Bloxham	3·54	,,	Melrose, Abbey Gate ...	3·64
,,	Northampton, Sedgebrook	2·75	XIII.	N. Esk Res. [Penicuick]	2·80
,,	Alconbury	2·02	,,	Edinburgh, Blacket Pl..	2·79
,,	Wisbech, Bank House..	2·76	XIV.	Glasgow, Queen's Park.	2·68
IV.	Southend	3·05	XV.	Inverary, Newtown	3·25
,,	Harlow, Sheering	2·88	,,	Islay, Gruinart School..	1·22
,,	Colchester, Lexden.....	2·12	XVI.	Dollar.....	2·19
,,	Rendlesham Hall	1·54	,,	Balquhidder, Stronvar..	4·61
,,	Diss	2·46	,,	Ballinluig	3·32
,,	Swaffham	2·84	,,	Dalnaspidal H.R.S. ...	3·79
V.	Salisbury, Alderbury...	3·46	XVII.	Keith H.R.S.	3·57
,,	Bishop's Cannings	3·92	,,	Forres H.R.S.	1·77
,,	Blandford, Whatcombe.	4·14	XVIII.	Fearn, Lower Pitkerrie.	2·27
,,	Ashburton, Holne Vic....	8·52	,,	Loch Shiel, Glenaladale	3·39
,,	Okehampton, Oaklands.	6·83	,,	N. Uist. Loch Maddy ...	3·01
,,	Hartland Abbey	6·10	,,	Invergarry	1·35
,,	Lynmouth, Glenthorne.	5·60	,,	Aviemore H.R.S.	1·62
,,	Probus, Lamellyn	5·70	,,	Loch Ness, Drumnadrochit	1·96
,,	Wellington, Sunnyside..	4·33	XIX.	Invershin	1·35
,,	Wincanton, Stowell Rec.	4·23	,,	Scourie	2·44
VI.	Clifton, Pembroke Road	3·76	,,	Watten H.R.S.	3·01
,,	Ross, The Graig	4·96	XX.	Dunmanway, Coolkelure	6·92
,,	Wem, Clive Vicarage ...	3·27	,,	Fermoy, Gas Works ...	6·08
,,	Cheadle, The Heath Ho.	3·55	,,	Killarney, Woodlawn ...	6·53
,,	Worcester, Diglis Lock	2·19	,,	Tipperary, Henry Street	4·33
,,	Coventry, Coundon	3·64	,,	Limerick, Kilcornan ...	3·00
VII.	Ketton Hall [Stamford]	2·54	,,	Ennis	4·00
,,	Grantham, Stainby	2·99	,,	Miltown Malbay.....	4·81
,,	Horncastle, Bucknall ...	2·97	XXI.	Gorey, Courtown House	6·00
,,	Worksop, Hodsck Priory	3·36	,,	Athlone, Twyford	4·21
VIII.	Neston, Hinderton	3·16	,,	Mullingar, Belvedere ...	3·34
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	1·68
,,	Broughton-in-Furness..	6·64	XXII.	Galway, Queen's Coll...	...
IX.	Ripon, Mickley	4·67	,,	Crossmolina, Enniscoe..	6·03
,,	Scarborough, South Cliff	4·74	,,	Collooney, Markree Obs.	3·43
,,	East Layton [Darlington]	5·45	,,	Ballinamore, Lawderdale	4·37
,,	Middleton, Mickleton..	5·01	XXIII.	Lough Sheelin, Arley ..	3·43
X.	Haltwhistle, Unthank..	3·21	,,	Warrenpoint	8·43
,,	Bamburgh.....	4·28	,,	Seaforde	10·07
,,	Keswick, The Beeches...	5·66	,,	Belfast, Springfield	7·26
XI.	Llanfrechfa Grange	6·34	,,	Bushmills, Dundarave...	2·70
,,	Llandovery	6·55	,,	Stewartstown	5·83
,,	Castle Malgwyn	6·87	,,	Buncrana	3·30
,,	Builth, Abergwessin Vic.	8·52	,,	Lough Swilly, Carrablagh	2·44

OCTOBER, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	4·45	+ 1·56	1·35	30	17	62·1	2*b*	31·2	17
II.		Maidstone (Hunton Court)...	4·47	+ 1·01	1·71	30	18	...	...	...	...
,,		Strathfield Turgiss	4·58	+ 1·74	·99	30	23	64·2	11	28·4	17
III.		Hitchin	2·30	— ·77	·44	24	19	61·0	13	29·0	21
,,		Winslow (Addington)	3·07	— ·02	·70	30	22	64·0	12	26·0	22
IV.		Bury St. Edmunds (Westley)	2·22	— 1·05	·55	24	19	59·0	7	33·0	22
,,		Norwich (Brundall)	2·85	...	·43	28	25	64·5	7	31·2	22
V.		Weymouth(LangtonHerring)	3·82	+ ·28	·65	20	13	66·0	11	36·0	17
,,		Torquay (Cary Green)	7·76	...	1·42	19	14	64·5	11	36·0	19
,,		Polapit Tamar [Launceston]..	5·11	+ ·18	1·01	26	15	68·0	9	38·0	16
VI.		Stroud (Upfield)	4·21	+ 1·18	1·23	30	20	69·0	11	34·0	21
,,		ChurchStretton(Woolstaston)	3·93	+ ·16	1·05	26	18	63·0	11	30·0	22
,,		Tenbury (Orleton)	4·05	+ ·84	·83	26	18	65·0	13	27·0	22
VII.		Leicester (Barkby)	2·21	— ·94	·48	26	19	63·0	11*c*	19·0	21
,,		Boston	2·41	— ·70	·58	27	17	65·0	7, 11	30·0	22
,,		Hesley Hall [Tickhill].....	3·18	+ ·08	1·00	20	19	65·0	1	24·0	23
VIII.		Manchester(PlymouthGrove)	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ..	2·34	— ·79	·46	24	16	...	...	...	...
,,		Skipton (Arncliffe)	...	...	...	...	...	...	...	...	...
,,		Hull (PearsonPark)	5·26	+ 1·61	1·56	20	21	61·0	1, 7	26·0	23
X.		Newcastle (Town Moor)	4·78	+ 1·66	·65	20	21	...	...	...	...
,,		Borrowdale (Seathwaite).....	13·84	+ 3·25	4·11	24	18	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	5·72	+ 1·18	1·41	24	16	..	...	...	...
,,		Haverfordwest	6·26	+ 1·11	1·64	23	16	66·0	6	29·9	3
,,		Aberystwith (Gogerddan) ...	5·64	+ ·29	·98	27	15	66·0	7, 9	24·0	14
,,		Llandudno.....	4·88	+ 1·49	1·08	20	17	62·5	9	32·0	22
XII.	SCOTLAND.	Cargen [Dumfries]	4·45	+ 1·19	1·28	23	10	63·4	11	21·0	22
,,		Jedburgh (Sunnyside).....	2·96	+ ·31	·54	26	16	65·0	13	20·0	23
XIV.		Colmonell	5·14	...	1·48	31	11	65·0	12	22·0	21
XV.		Lochgilphead (Kilmory).....	2·94	— 1·85	·45	28	12	...	...	24·0	18
,,		Mull (Quinish).....	2·43	— 2·86	·79	9	13	...	...	...	...
XVI.		Loch Leven Sluices	4·60	+ 1·64	1·10	24	10	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·55	+ 1·31	·90	23	19	62·1	10	26·2	19
XVII.		Braemar	3·02	— ·59	·87	31	16	62·0	2	17·8	23
,,		Aberdeen (Cranford)	3·08	...	·55	31	22	65·0	2	26·0	22
XVIII		Strathconan [Beauly]	1·42	— 3·23	·45	19*a*	7	...	...	...	...
,,		Glencarron Lodge.....	3·16	...	1·27	12	19	59·9	2	25·8	19
,,		Cawdor [Nairn]	2·17	— ·56	·59	18	15	...	...	...	...
XIX.		Dunrobin	2·27	— 1·04	·50	19	13	62·0	2	31·0	23*c*
,,		S. Ronaldsay (Roeberry).....	3·31	— ·42	·66	24	20	60·0	2	34·0	17
XX.	IRELAND.	Darrynane Abbey.....	5·18	...	1·56	23	13	...	...	...	...
,,		Waterford (Brook Lodge) ...	5·67	+ 1·85	1·43	23	15	65·0	11	32·0	15
,,		O'Briensbridge (Ross)	2·26	...	·59	27	11	..	...	...	...
XXI.		Carlow (Browne's Hill)	4·80	+ 1·51	1·38	23	16	...	..	...	...
,,		Dublin (FitzWilliam Square)	3·97	+ ·59	1·04	23	20	62·8	31	36·0	22
XXII.		Ballinasloe	4·23	+ 1·24	·80	23	15	61·0	1	27·0	15
,,		Clifden (Kylemore)	7·25	...	1·60	24	15	...	...	...	...
XXIII		Waringstown	5·51	+ 2·80	1·58	23	19	65·0	13	26·0	21
,,		Londonderry (Creggan Res.).	2·90	— ·77	·64	23	17	...	...	...	...
,,		Omagh (Edenfel)	3·91	+ ·81	1·35	23	16	63·0	12	22·0	21

a And 26. *b* And 11, 13. *c* And 12, 13. *d* And 27. *e* And 28.

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

CAMDEN SQUARE.—The min. temp. in shade for September was 36°·7 on 28th, not as printed 39°·3 on 29th.

STRATHFIELD TURGISS.—The early portion of the month was mild and fair; from the 14th to the 17th a sharp snap of frost occurred, and a heavy gale on the 24th. Thence to the end of the month constant heavy rains and floods. T on 24th. The river Loddon flooded on 31st. Swallows last seen on 12th.

ADDINGTON.—A very dull, unsettled month, only one or two bright days. The 1st, 8th, 9th and 13th were foggy, and sharp frost occurred on the morning of the 22nd. High wind on the 24th, 25th and 26th. Three sharp claps of T and flashes of L about midday on 24th, and much L the same night, also on the night of the 25th. The rains at the end of the month caused the brook to overflow the meadow; the only flood for a long time. The last night of the month very mild, the min. temp. being 52°.

BURY ST. EDMUNDS.—A month of low temp., almost without frost, and little sunshine. The first ten days very misty, distant T on 28th.

NORWICH, BRUNDALL.—Rainfall very near the average, but the number of rainy days large. Temp. about 1° above the average. An unusual preponderance of northerly winds (N.W. to E.) viz., 52 days between August 21st and October 21st. L on 7th, 19th and 29th. Fog on 9th. H on 14th. Gale from S.W. in night of 25th.

LANGTON HERRING.—For the 25 days ending October 19th, the rainfall was only ·02 in., but on all of the last 12 days of the month heavy R fell, and the weather was very mild and damp. Mean temp. 50°·9, or 1° above the average of 23 years. There was a sudden fall of temp. on the 15th, when the min. was 13° lower than on the previous day; the cold period lasted to the 24th, when the min. was 11° above that of the 23rd. From the 24th to 27th inclusive was very stormy. T and L on 20th, 21st, 24th, 25th and 26th. Fog on the 9th.

TORQUAY, CARY GREEN.—Rainfall 3·57 in. above the average. Mean temp. 52°·3, or 1°·9 above the average. Amount of sunshine 90 hours 45 minutes, being 27 hours 15 minutes below the average; five sunless days.

POLAPIT TAMAR.—The early part of the month was fine and bright, but the last 12 days were remarkable for the quantity of R that fell. Only ·13 in. fell before the 20th, but on and after that date 4·98 in. fell. This wet period was accompanied throughout by very strong winds or gales.

WOOLSTASTON.—The first three weeks were fine, but the latter part of the month was wild and boisterous, with constant R. Heavy gales on the 23rd and 24th. Mean temp. 47°·6.

TENBURY, ORLETON.—The first half of the month was fairly dry, but from the 23rd to the end there was almost incessant R, more than 3·50 in. falling in the last nine days. Temp. about 1°·0 above the average. Fog very frequent. T on 27th; L on 29th.

LEICESTER, BARKBY.—A wet, warm month, especially at the end, the R being most acceptable. Mean temp. 47°·6. T on 26th. In these parts a wet day is now regarded as a *fine* day.

SEATHWAITE.—In the last nine days of the month 12·48 in. of R fell, the amounts exceeding an inch on six days.

WALES.

HAVERFORDWEST.—The month at the commencement was a continuation of the cold which prevailed during the last five days of September, the grass temp. on the 3rd falling to 25°·6. Some R fell during the second week, and the temp. rose. Fine autumnal weather, with dense fog, air calm, and temp.

high for October, then prevailed; the wind, which had blown persistently from the N. and N.E., backed to S.E. at the end of the third week, and a rainy period commenced, and 5·32 in. of R fell in the last nine days.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout the month, with strong winds from the S.

SCOTLAND.

CARGEN.—Until the 23rd of the month the meteorological conditions were almost exactly the same as prevailed from August 15th through September. Little R fell (·30 in.), light easterly winds prevailed, and a high bar. Foggy weather was more frequent, and there was considerably less sunshine than in the former period. From the 15th August to the 23rd of this month—69 days—only seven-tenths of an inch of R fell. The only occasion on which we have had a drought to be compared with this during the last 34 years was in 1868, when from the 26th May to the 6th August—73 days—1·02 in. of R fell. The R for the last nine days of the month amounted to 4·15 in. The mean temp., 45°·7, is 2°·2 below the average, and the duration of sunshine 50 hours below it. Light easterly winds prevailed for 20 days.

JEDBURGH.—The weather up to the middle of the month was comparatively mild with little or no wind, which retarded the ingathering of the corn. After that the temp. fell decidedly and R was frequent with much wind. The cereal crops have attained fully an average, but in higher districts there is still much grain on the fields.

COLMONELL.—Rainfall slightly above the average.

MULL, QUINISH.—A most beautiful month, the high temp. and freedom from gales making it seem a continuation of summer.

BRAEMAR.—With the exception of the first week, the weather has been very calm, dull, and muggy, consequently the crops are are still unsecured and in bad condition. Duration of sunshine 82 hours 10 minutes.

ROEBERRY.—A very fine month upon the whole. Mean temp 47°·1.

IRELAND.

DARRYNANE ABBEY.—Fine and fairly warm to the 16th. Very cold, with frost at night from 17th to 23rd; wet and mild after. Heavy R and gale on the 24th.

WATERFORD, BROOK LODGE.—The fine weather that commenced after the TS on August 25th broke up with another heavy storm on the 20th of this month, and a quantity of L on the 21st. Heavy S.W. gale on the 24th. Mean temp. 49°·5.

O'BRIENSBRIDGE, ROSS.—After three weeks of very fine autumnal weather, R and heavy gales from S.W. closed the month; on the whole a most favourable one.

DUBLIN.—The first half of the month was quiet, fine, and, for the most part, dry. Until the 18th very little R fell, but from that day onward to the close large quantities were measured almost daily. Mean temp. 49°·7, exactly the average. There was a TS on the 20th. High winds were noted on 9 days, but attained the force of a gale only on the 24th. Fogs on 9 days. H on the 19th and 20th.

WARINGSTOWN.—Heavy floods in the latter half of the month.

EDENFEL.—The drought and settled fine weather which set in on August 27th did not break up till October 20th. In that long period of 53 days only ·77 in. of R fell, ·45 in. of which fell on October 9th; a quite unprecedented record. The activity of the elements, however, from the 20th to the close more than made up the lee way and resulted in a R nearly an inch above the average for the month.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

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A Monthly Review of Astronomy.

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T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

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THE FLOODS OF NOVEMBER, 1894.

I AM in a little difficulty in deciding as to the best mode of dealing with this subject, and think that, on the whole, this article had better begin with a brief historical statement. All my readers are probably aware that after a very dry September and first two-thirds of October a wet period set in over the southern half of England and part of Wales, which period lasted until about the middle of November, and that floods, disastrous in some places, resulted from this wet three weeks. Whether or not the flood was worst in the valley of the Thames, or in Cornwall, has yet to be determined, but it was a very high one on the Thames, and Mr. Sowerby Wallis and I went to various places on its banks to fix its height relatively to previous floods, with the object of giving a full account of it. Subsequently at the Council Meeting of the Royal Meteorological Society, a strong desire was expressed that the work should be done in connection with, and the results presented to, that Society. Mr. Chatterton, M.I.C.E., undertook to work up the engineering part of the report, and I promised to tabulate the rainfall, and supply all the old records in my possession as to the height of previous floods. To deal properly with the Thames alone will take some months, and I can say little as to the final form which the work will take, as we are in communication with the officers of the Thames Conservancy, and details are not settled.

One branch of the question is disposed of; Mr. H. Southall, F.R.Met.Soc., of Ross, Herefordshire, has promised a paper on the floods in the Severn, Wye and Usk, and as he has long been an assiduous observer of the levels of those rivers, his paper, which will be read at the Royal Meteorological Society on December 19th, is sure to be useful and important.

It may sound rather wild to say that I cannot give here a thousandth part of the information already collected, but that is far within the mark.

The first step was to obtain the newspaper accounts of the flood; because however satirical some persons might be as to "penny-a-liners," long experience has taught me that much very valuable information appears in local newspapers *and nowhere else.* The

newspaper cuttings (rejecting duplicates) already mounted and classified would, if joined up in one continuous column, be 600 ft. long, nearly $\frac{1}{8}$th of a mile.

The rainfall observers in the area affected must number nearly 1,000.

As the result of two communications inserted in *The Times* I received numerous letters giving local details.

An assistant has been going through files of old newspapers at the British Museum, and extracted many pages of notes of the heights of floods in this and the previous century.

The Thames Conservancy Board have promised to place their records at our disposal.

I wrote to the Engineer or Borough Surveyor of each town up the Thames as far as the City of Oxford, and these gentlemen are sending in valuable maps and reports.

It is evident that it will take much time to reduce all this matter to proper form. On the present occasion, therefore, I give merely two pages of rain returns from the districts chiefly affected, and a selection from the letters with which I have been favoured, arranged in the order adopted in *British Rainfall.*

Before doing so I wish to reprint two paragraphs from an article in the *Meteorological Magazine* for January, 1877—and just as necessary now as they were 17 years ago.—G. J. SYMONS.

FLOODS, AND A PLEA FOR FLOOD MARKS.

"We have put at head of this article 'A Plea for Flood Marks,' and we beg of our readers to do all in their power (1) to discover and protect all existing records of the height of bygone floods; (2) wherever practicable, to have their relation to Ordnance datum accurately determined, and, when that has been done, to send us for publication a note of the results; (3) to have new marks of the level of the 1877 floods cut wherever practicable, if possible, determining their height above Ordnance datum, and reporting the details to us for publication. A mere horizontal line or, better still, a mark like this $\text{X}\overset{1877}{\text{———}}\text{X}$ is all that is necessary."

"It may be thought that in making this suggestion we are passing beyond our own province, into that of Engineers. Limits are always hard to fix, and if there existed any published details of the class we indicate we should not interfere. But although the records of the floods of continental rivers are kept with accuracy and published extensively, we do not know where to obtain similar data for English rivers and floods. We have had to create an organization for the registration of rainfall,—shall we be obliged to supplement it by a Chronicle of Floods?"

SUNBURY VICARAGE.—This house was, as in Mr. Cowe's report of the 1795 flood, dry and comfortable. In 1852 we had some two to three feet of water in our wine cellar. This year a very little came

into the coal cellar. In 1852, on the road to the station, it was necessary to take a punt near Hawke House. This year it was not so. Hence I think we may take it there was less inconvenience from land springs this year than in 1852, probably owing to the short rainfall in 1893 and the preceding years. Some persons think that the pumping from wells by the East London Water Works, on the confines of this Parish and Hanworth, has lowered our springs and emptied our ponds. I do not give much credence to this idea, for I cannot think that the cone of exhaustion could extend as far as it is credited to do; and my experience, during extended walks both on this side of the Thames and in Surrey, is that all ponds have been very empty the last two or three years. As to the height of the flood, Drew, the river keeper, tells me there is a mark of the 1821 flood on the old lock house where he resides, and that the present flood at its highest was 3 to 4 inches above it. He has no mark of 1852. Mrs. Clark at the ferry tells me that she distinctly remembers that the 1852 flood did not go above a certain step on some stairs which run up her house; this flood rose at least a foot above that. In 1852 we had to take cart at Walton Bridge to get to the Sunbury and Shepperton road. We had to take a punt at Gurston Bridge, Upper Halliford (this was necessary this year, and I should imagine this is from a back flow from the Thames, as the stream only rises at Staines, and is dammed back at Littleton to form a lake, which did not flood), at the junction of the Sunbury and Halliford road and the lower road from Sunbury to Shepperton. We took punt to the Vicarage corner—as far as my memory serves me. I am distinctly under the impression that the water in that year (1852) did not flow very far up the first-named road, whereas this year it was flooded for quite 100 yards, when the water found its way into a low-lying paddock belonging to the Hedges family, then into the gardens of several adjoining cottages, across a drift road into one of our glebe fields, and partly turning northwards up the road, it flowed into a large disused gravel-pit and flooded it. This pit was flooded in 1852, but I think from land-springs. When I crossed the river on Saturday to see the river keeper, I came in contact with an officer of the Thames Conservancy, who was doing his utmost to stop a very considerable blow just above our lock, in the embankment between the cut to the lock and the main river, which has almost demolished the very extensive boathouse belonging to E. Clark and Sons.—F. H. Vigne.

Twickenham, Manor Road.—The flood here was the highest known within the memory of the inhabitants, being somewhat in excess of the flood of 20 years ago. As you are aware, we are in the tidal part of the river, with a rise and fall of a few feet every tide. On the 15th inst. the water in the Thames, which had been increasing for some time previously, began to overflow the banks, and at high tide that day (about 4 p.m.) was level with our esplanade wall, 15·25 ft. above Ordnance datum. It continued to increase from

Rainfall in Southern and Central England and in Wales, October 11th to November 14th, 1894.

Div.	County.	Station.	Oct. 20th to Nov. 10th.	November				Nov. 11th to Nov. 14th.
				11th.	12th.	13th.	14th.	
			in.	in.	in.	in.	in.	in.
I.	Middlesex ...	London, Camden Square	4·51	·43	·62	·11	·66	1·82
,,	,, ...	Muswell Hill	4·09	·46	·72	·16	·71	2·05
,,	,, ...	Pinner Hill	4·04	·13	·40	1·00	·19	1·72
II.	Surrey.....	Haslemere, Hazelhurst.....	6·62	·84	·83	·65	1·34	3·66
,,	,, ...	Abinger Hall	6·32	·62	·64	·58	1·18	3·02
,,	,, ...	Farnham, Seale	4·32	·49	·82	·38	1·04	2·73
,,	,, ...	Wallington	5·56	·37	1·01	·22	1·11	2·71
,,	Kent	Tenterden	3·97	1·12	·34	·21	·81	2·48
,,	,, ...	Hythe	4·72	·63	·29	·11	·72	1·75
,,	,, ...	Seven Oaks, Riverhead..	4·19	·73	·74	·11	·96	2·54
,,	,, ...	Keston Tower	5·76	·45	1·23	·11	1·06	2·85
,,	,, ...	Birchington, Thor	2·66	·91	·27	·02	·60	1·80
,,	,, ...	Sheppey, Leysdown	3·51	·52	·45	·07	·54	1·58
,,	Sussex.....	Steyning	6·02	2·16	·87	·13	·97	4·13
,,	,, ...	Hailsham	4·97	1·15	·52	·21	1·06	2·94
,,	,, ...	Ditchling	5·45	1·63	·35	·18	·85	3·01
,,	,, ...	Crowborough Observatory	5·98	1·72	·61	·29	1·09	3·71
,,	Hants	Osborne, Newbarn Cottage	6·29	2·13	·71	·44	1·43	4·71
,,	,, ...	Emsworth, Redlands...	6·96	1·49	·59	·49	1·31	3·88
,,	,, ...	Alton, Ashdell	6·53	·78	·97	·80	1·27	3·82
,,	,, ...	Whitchurch, Longparish	5·51	·69	1·05	·66	1·37	3·77
,,	,, ...	Strathfield Turgiss.....	5·06	·52	1·25	·41	1·19	3·37
,,	Berks	Newbury, Welford Park	5·04	·56	1·66	·74	1·34	4·30
,,	,, ...	Lamborne.....	5·00	·73	1·47	·89	1·40	4·49
III.	Hertford.....	Broxbourne, Stafford House ...	3·83	·42	·62	·18	1·05	2·27
,,	,, ...	Berkhamstead, Rosebank.....	3·86	·50	1·62	·56	1·02	3·70
,,	,, ...	Hitchin, Wratten	2·55	·42	1·37	·25	1·07	3·11
,,	Bucks	Wendover, Halton Gardens.....	4·08	·54	1·22	·47	1·33	3·56
,,	,, ...	Addington Manor	3·72	·29	1·01	·53	1·02	2·85
,,	Oxford	Henley-on-Thames.....	4·90	·49	1·11	·40	1·18	3·18
,,	,, ...	Abingdon, Culham.....	4·07	·50	1·39	1·00	1·28	4·17
,,	,, ...	Watlington, Pyrton Manor	4·17	·52	1·26	·47	1·51	3·76
,,	,, ...	Steeple Aston, The Grange	3·64	·26	1·19	·91	·63	2·99
,,	,, ...	Banbury, Bloxham Grove.....	3·91	·27	1 09	·80	·42	2·58
,,	Northants ...	Pitsford, Sedgebrook.....	2·94	·16	1·14	·48	·53	2·31
,,	Hunts	Alconbury	2·31	·14	·94	·09	·62	1·79
IV.	Essex	Saffron Walden, Newport	2·37	·35	·51	·11	·79	1·76
,,	Suffolk	Rendlesham Hall	1·51	·38	·67	·28	·34	1·67
,,	Norfolk	Diss	2·10	·26	1·26	·02	·56	2·10
,,	,, ...	Swaffham.....	3·00	·25	1·03	·04	1·44	2·76
V.	Wilts	Salisbury, Alderbury	4·93	·81	1·11	·72	1·24	3·88
,,	,, ...	Bishops Cannings	5·14	·80	1·65	·70	1·70	4·85
,,	,, ...	Marlborough, Mildenhall.....	4·60	·54	1·85	·51	1·49	4·39
,,	,, ...	New Swindon	5·06	·62	1·55	·91	·93	4·01
,,	Dorset.....	Portland	5·57	2·07	1·06	·83	1·17	5·13
,,	,, ...	Weymouth, Langton Herring...	6·11	1·50	·97	·59	1·13	4·19
,,	,, ...	Maiden Newton	8·21	1·29	1·45	1·12	1·20	5·06
,,	,, ...	Blandford, Whatcombe.....	6·51	1·27	1·00	·94	1·40	4·61

Rainfall in Southern and Central England and in Wales, October 11th to November 14th, 1894—(continued).

Div.	County.	Station.	Oct. 20th to Nov. 10th.	November.				Nov. 11th to Nov. 14th.
				11th.	12th	13th.	14th	
			in.	in.	in.	in.	in.	in.
V.	Devon.....	Torquay, Cary Green	8·68	2·03	·93	1·35	·46	4·77
,,	,, ...	Ashburton, Druid House	12·68	2·32	1·45	2·65	·44	6·86
,,	,, ...	Tavistock, Rose Villa	8·20	1·68	1·77	2·04	·50	5·99
,,	,, ...	Polapit Tamar [Launceston] ...	8·00	1·60	1·02	1·11	·42	4 15
,,	,, ...	Okehampton, Oaklands.....	9·77	1·20	1·50	1·26	·67	4 63
,,	,, ...	Hartland Abbey.....	8·50	·84	1·35	1·28	·45	3·92
,,	,, ...	Lynmouth, Glenthorne.....	8·59	·53	1·54	1·74	·62	4·43
,,	Cornwall ...	Penzance, St. Clare	8·10	2·56	·38	·88	·44	4·26
,,	,, ...	St. Ives, Phillack Rectory	7·05	2·00	·70	1·52	·31	4·53
,,	,, ...	Redruth, Trewirgie	9·00	2·26	·56	1·50	·46	4·78
,,	,, ...	Probus, Lamellyn	8·38	1·34	1·22	1·52	·48	4·56
,,	,, ...	St. Agnes.....	8·26	2·28	·82	1·30	·40	4·80
,,	,, ...	Bodmin, Lanhydrock	8·99	1·78	1·42	1·41	·35	4·96
,,	Somerset ...	Wellington, Sunnyside	6·18	1·10	1·20	1·12	·62	4·04
,,	,, ...	Stowell Rectory	6·69	1·13	1·10	·65	1·06	3·94
,,	,, ...	Wells (*Garden*)	6·04	·78	1·03	·65	·55	3·01
VI.	Gloucester ...	Clifton, Pembroke Road	5·33	·53	1·64	·53	·64	3·34
,,	,, ...	Almondsbury	5·64	·50	1·34	1·06	·56	3·46
,,	,, ...	Lechlade	5·16	·30	1·30	·66	1·10	3·36
,,	,, ...	Cirencester, Further Barton ...	6·59	·37	1·13	1·17	·58	3·25
,,	,, ...	Stroud, Upfield	5·29	·40	·96	·91	·44	2·71
,,	,, ...	Great Barrington	5·10	·28	1·11	1·00	·78	3·17
,,	,, ...	Moreton-in-Marsh, Longborough	4·39	·16	1·30	1·03	·58	3·07
,,	Hereford.....	Ross, The Graig	5·53	·19	·62	·83	·31	1·95
,,	Salop	Church Stretton, Woolstaston...	4·49	·05	·71	·96	·10	1·82
,,	Stafford	Cheadle, Heath House	3·67	·03	·48	·60	·25	1·36
,,	Worcester ...	Tenbury, Orleton	4·69	·06	·92	·82	·21	2·01
,,	Warwick ...	Coventry, Coundon	3·66	·11	·89	·85	·39	2·24
VII.	Leicester ...	Barkby.....	2·14	·04	·67	·36	·38	1·45
,,	Lincoln	Horncastle, Hemingby	2·79	·05	·54	·47	·37	1·43
,,	Notts	Hesley Hall [Tickhill]	2·59	·03	·43	·23	·13	·82
,,	Derby	Derby	2·26	·04	·62	·45	·31	1·42
VIII.	Cheshire.....	Frodsham, Dunsdale	3·59	·01	·01	·61	·05	·68
XI.	Monmouth...	Llanfrechfa Grange	7·93	·58	·47	1·64	·32	3·01
,,	,, ...	Llanvihangel Court	7·33	·21	1·32	1·28	·28	3·09
,,	Glamorgan...	Cardiff, Ely.....	7·35	·40	·76	·91	·42	2·49
,,	Carmarthen..	Llandovery	8·82	·48	·77	1·96	·25	3·46
,,	Pembroke ..	Haverfordwest	7·61	·33	·70	1·65	·20	2·88
,,	,, ...	Castle Malgwyn	9·02	·16	·10	1·70	·13	2·09
,,	Cardigan.....	Aberystwith, Gogerddan	6·25	·15	·21	1·39	·18	1·93
,,	Radnor	New Radnor, Ednol	8·10	·15	·78	1·44	·22	2·59
,,	Montgomery	Lake Vyrnwy	9·87	·21	·83	1·83	·13	3·00
,,	Merioneth ...	Corwen, Rhug Gardens.....	4·07	·27	·09	·81	·08	1·25
,,	Carnarvon ...	Carnarvon, Cocksidia	8·11	...	·40	1·25	·04	1·69
,,	,, ...	Llandudno, Warwick House ...	5·08	·01	·04	·79	·02	·86

the 15th to the 18th, there being, of course, a slight rise and fall with every tide, but during the whole of that time the water level did not go below the 15·25 ft., except a little on the 15th. The maximum height was reached at the time of high water in the evening of the 18th, when it was about 19·00 ft. above Ordnance datum. The difference between high and low water on that occasion was 1 ft. 3 in.—An old mark is cut here, giving the height of a flood that occurred in March, 1774, and that mark is 2 ft. 9½ in. above the mark I made of the highest water on the 18th. From the 18th the waters fell subject to a rise and fall for each tide, and after the 22nd inst. did not again come over the esplanade, 15·25 ft. The river Colne, which passes this district, also overflowed its banks, and from the 15th to the 22nd a great extent of the low-lying land in this district was under water. Some of our roads also were under water, and large quantities got into our sewers. There is a half-tidal weir with sluices at Richmond, but as the sluices were open the whole time of the flooding, I do not think it made any difference to this district.—G. B. LAFFAN.

HASLEMERE, HAZELHURST.—The rainfall here at the end of October was unusually great, and may be worth recording. I greatly regret, however, that my absence from home during the day prevented any record of the rate at which the rain fell.

Oct. 24	1·34 in.	Oct. 28	0·43 in.
,, 25	0·11 ,,	,, 29	0·30 ,,
,, 26	1·13 ,,	,, 30	1·06 ,,
,, 27	0·25 ,,	Total	4·62 in.

I have never before known three falls of over an inch within seven days. Hazelhurst is on the southern flank of Hindhead, and 550 feet above sea level. From the deep channels cut on the higher ground, the rain would appear to have been still heavier there.—T. P. NEWMAN.

CHIDDINGFOLD.—On October 24th, between 8.30 a.m. and 0.15 p.m., or 3¾ hours, 1·22 in. of R fell. In the 24 hours 1·64 in. fell. Moderate S.W. gale in the day, with increase of force, and heavy squalls at night.—A. F. PARBURY.

TENTERDEN.—The floods at Smallhythe (November 16th) are not considered so high by 18 inches as those of 1877. I believe they were worse in 1880 than this year, and of course in 1865, but from Snargate, Romney Marsh, my man reported the worst flood for years on 14th, and that would be before the whole of that day's fall had run down.—J. ELLIS MACE.

SIDCUP, HATHERLEY ROAD.—On the morning of October 31st I measured 3·56 in. of R. Whenever I have an unusual fall I make a mark with a pencil as I empty each half-inch into a jug, and then verify the amount by measuring a second time. I do not think my rain-gauge had been tampered with, as it is in direct view of my house. On the morning of the 31st, when the rainfall was over, the

South Eastern Railway at New Eltham was more flooded than by the heavy rains of the middle of November. The R commenced about 6.30 a.m., and continued steadily all day, and in the evening and night came down in torrents.—L. BURRELL.

CHICHESTER, WESTGATE.—There was a fall of 2·68 in. of R between 6 p.m. on Sunday, November 11th, and 9 a.m. on Monday, 12th.—N. TYACKE.

COMPTON [PETERSFIELD].—From October 21st to November 17th, rain fell more or less heavily on each day, and the amount for the four weeks came to exactly 12 inches. The greatest falls occurred on Oct. 25th, 1·23 in.; 27th, 1·07 in.; 31st, 1·09 in.; Nov. 12th, 1·61 in.; 15th, 1·49 in. The copious rains of July, September, and October have caused the springs in the chalk to rise earlier than usual and in much greater volume. My well (155 ft. deep) rose, between October 15th and November 15th, from 15 ft. to 51 ft., a rise of 36 ft. in the month.—H. MARMADUKE LANGDALE.

DITCHLING.—The rainfall here from October 20th to November 16th was 9·16 in. R was recorded on each day with the exception of November 8th.—F. H. PHILLIPS.

CROWBOROUGH, THE OBSERVATORY.—I was surprised to see by Monday's Weather Chart that only ·29 in. of rain fell in London on November 11th, while here it amounted to 1·72 in., and from 6 p.m. on Sunday, 11th, to 6 p.m. on Monday, 12th, 2·33 in. From October 20th to November 15th inclusive I have registered 10·28 in. Rain fell every day during the period. We have not had such a soaking since 1865.—C. LEESON PRINCE.

EAST GRINSTEAD, HALSFORD.—Between 7 p.m. on November 11th and 8 a.m. on November 16th, 3·78 in. of R fell.—W.V. K. STENNING.

OSBORNE.—The rainfall registered here at 9 a.m. November 12th was 2·13 inches, that amount having fallen from about 5 p.m. on 11th, when the rain commenced, up to 9 a.m. on 12th. This is the greatest amount recorded at Osborne on any day since the commencement of observations in 1857, the greatest previous amount having been 2·05 in. on 26th September, 1859,—R. SCOTT.

SONNING MILLS.—A very curious coincidence has occurred in the dates of the highest point reached by the water at Sonning Lock in the three great floods on the Thames, of which an authentic account has been kept. I can find no other records of a big flood since 1809. The three great floods took place in 1852, 1875, and 1894, and the highest point reached in 1852 was on November 17th; in 1875 the highest point was on November 16th; in 1894 the highest point was on November 16th. It certainly seems curious that the water on each occasion should have reached its highest point almost on the same day of same month. The present flood was 9 inches higher than in 1875, and 11 inches higher than in 1852. It is useless to compare the floods of 1809 and 1821 with this one; the conditions and state of river are so different. In the olden time no dredging was done, and no new weirs built. I enclose the heights of various floods from

1852 until now, giving you the greatest height the water reached above our high water mark at Sonning Lock :—

		Height Above High Water Mark. ft.	in.
1852.	November 17th ...	3	3
1875.	November 16th ...	3	5
1876.	December 31st	2	6
1877.	January 6th	3	1½
1877.	November 30th ...	1	8
1878.	February 16th	1	1½
1879.	January 5th	2	6
1879.	August 26th	2	6
1880.	November 1st	2	4
1881.	February 12th	2	6
1881.	December 20th.....	2	7
1882.	October 28th	3	3½
1883.	February 13th	3	3½
1886.	November 15th ...	1	0
1891.	October 24th	3	2
1894.	*November 16th ...	4	2

* This is the highest flood on record at Sonning, and was 9 inches above the 1875 flood.

—ILTID WITHERINGTON.

SLOUGH, UPTON.—A civil engineer resident in the district reports the flood here as 13 inches above that of 1877–8, and 4 inches above the "Duke of Wellington flood" of 1852.

Since midnight Friday, November 16th there has not been a drop of water in the mains at Slough. The engines of the water company being submerged. Only houses with "fire storage" for hydrants have any reserve. The flood is said to have culminated at a quarter before 2 p.m. on Saturday. Communication cut off between Slough and Datchet, and Slough and Eton, except by boat (or train viâ Windsor). Three feet of water over Datchet Road at Upton end and four and five feet at Datchet end.—R. BENTLEY.

BOURNE END, THE WHARF.—The flood was from 6 to 8 inches higher than in 1852 ; we had 4 ft. 6 in. of water in our dressing-room, and as near as I can tell it was 3 ft. 6 in. above the towing-path on the opposite side of the river. It is the highest flood that has been known by anyone living about here. Traffic was stopped on the Marlow branch owing to the depth of water on the metals.—E. TOWNSEND.

NEWPORT PAGNELL.—The rainfall for the first fortnight of November has been very exceptional. We have had 4·08 in. On the 11th and 12th I registered 1·28 in. continuous fall, and on 13th and 14th 1·50 in. also continuous. The consequence is that the Ouse has been flooded more than in the memory of any one I have met with. I have noted the rainfall here for 30 years, but have had no such experience. Scores of houses in Newport Pagnell have had flood water in them.—R. LITTLEBOY.

HENLEY ON THAMES.—In the recent floods in the Thames valley the water rose to within 12½ inches of the great flood of 1809, and 14 inches more than the flood of 1852. On the night of Friday, November 17th, the water rose 1 foot, and began subsiding on the 18th, and reached the river bounds on the 22nd.—R. PRATT.

ABINGDON, CULHAM VICARAGE.—The flood this year was at its height about here—I take Clifton Hampden Bridge, which is between here and Wittenham—at about 10 a.m. on November 16th, from that time until 4 p.m. it does not seem to have made any appreciable altera-

tion, though the man at the toll-house tells me that it might have risen possibly half an inch during that part of the day; at 4 p.m., he tells me, it was at a standstill, and shortly afterwards began to fall. On the morning of the 17th it had fallen considerably; it rose very rapidly from 9 p.m., Wednesday, 14th, to 9 p.m., Thursday, 15th, after that the rise was not great. I can tell you the exact hour at which the 1875 flood was at its heigth, which, with us at Wittenham, was 4 p.m. on November 15th. I don't know the hour of the 1852, though I know it was sometime in the daytime of the same date. There was a very violent storm between 9·30 a.m. and 11 a.m. on the 14th, which passed by here, and which seems to have been very heavy at Molton, the rain coming down in sheets. There is no doubt that the amount of water coming down the Ock at Abingdon, and which flooded the Ock Street at Abingdon in a way that was never known, and the water coming down the Thame stream below us, and which was very great, raised the flood about here enormously. I am told that at Little Wittenham the flood exceeded the 1809 flood. This is about 3 miles below Clifton Bridge, and 4 miles below Long Wittenham on the river. There was a very rapid rise and a very rapid fall as one might suppose; the rainfall of 1852 and 1875, which are the ones of which I have a record, having been nothing like the quantity in so short a time, in those years the rainfall was much more continuous and one very heavy fall.—F. C. CLUTTERBUCK.

AMESBURY, FIGHELDEAN.—It began to rain here on Sunday, November 11th, at five minutes to 6 p.m., and rained till 6.35 p.m. on Monday, 12th, during which time 2·37 in. fell. There was hardly any break in the R, except about midnight on Sunday and about 2 p.m. on Monday. There was a shower on Monday night, bringing the total for the two days up to 2·40 in. On Tuesday, the 13th, ·96 in. fell, and on the 14th 1·65 in. The Avon rose as high as in the flood of February, 1883.—G. KNOWLES.

SWANAGE, THE BANK.—We have had R for 28 consecutive days, October 20th to November 16th 10·98 in., (2·06 in. falling on 11th), while the preceding 26 days were without any R, except ·09 in. on October 16th. Only about 20 houses were flooded for a few hours on the 12th while the tide was at its height. We had 8·36 in. of R in the first 22 days of October, 1891.—J. ANDREWS.

POOLE, PARKSTONE.—Our absolute *anti-drought* ceased on the 16th, having lasted 28 days (October 20th to November 16th), and given us 10·93 in. of R. Being high and sandy, we have escaped floods.—R. H. BARNES.

HAZELBURY BRYAN RECTORY.—This (November 20th) is the first day I have not registered any rainfall since October 19th, 16·32 in. having fallen in the 30 days ending with November 18th. It is now more than 30 years since I commenced registering the rainfall in response to a letter of yours in the *Times* newspaper. I was then in the north of England. From that time on until now I have kept up my observations; but I never, as far as I can remember, knew

an unbroken series of 30 wet days in succession, or anything approaching to it. The rainfall of the last 30 days exceeds the whole rainfall of the first six months of 1893 by 1·13 in. The falls of an inch in 24 hours are :—

Oct. 26th	1·15 in.	Nov. 12th	1·92 in.
,, 28th	1·00 ,,	,, 13th	1·53 ,,
Nov. 7th.....	1·01 ,,	,, 14th	1·87 ,,
,, 11th	1·31 ,,		

—R. F. WHEELER.

ROUSDON [LYME REGIS].—In the floods of November 12th in the Axe Valley the water was 4 inches over the rails at the level crossing at Colyford Station.—C. E. PEEK.

PENZANCE, ST. CLARE.—R on November 11th, 2·56 in. My highest record for 24 hours during the last 30 years was 2·07 in., and only four times have I measured more than two inches.—P. W. HEDGELAND.

ST. AGNES.—From 2 p.m. on Sunday, November 11th, to 2 p.m. on 12th, 3·03 in. of R fell. This is the largest quantity known to have fallen here in 24 hours. The wind was S.W., blowing a gale, and veered to N.W. at noon.—J. OPIE.

LOSTWITHIEL, LANWITHAN.—I send you a record of rainfall from St. Ives taken from the *Western Morning News* :—"The rainfall of November 11th was phenomenal, nearly 5 inches having fallen during a few hours." The rainfall here was—November 11th, 1·86 in.; 12th, ·88 in.; 13th, 1·76 in.—M. FOSTER.

DOWLAIS, GWERNLLWYN.—In the 24 days ending November 15th, 15·57 in. of R fell, 3·34 in. falling on 12th, 13th, and 14th.—R. C. HARRISON.

REVIEWS.

Sanitary Series, No. 1. *Meteorology Practical and Applied*, by JOHN WILLIAM MOORE, B.A., M.D. (Dub.), F.R.C.P.I., F.R.Met.Soc., &c. London, F. J. Rebman, 1894, 8vo. viii.-445 pages, 76 engravings and plates.

DR. MOORE'S well-known devotion to Meteorology, his very modest preface, and the notice on the title page—"Sanitary Series No. 1"—place a reviewer in a somewhat difficult position. The author begins by saying, "The writing of this book has been to me a labour of "love. Should the reader derive some pleasure as well as informa- "tion from the perusal of its pages, the task set before me will not "have been undertaken and completed in vain." We are certain that this wish will be amply satisfied. But there are other points to be considered. This book is "Sanitary Series No. 1," and on page vi. Dr. Moore calls it a "popular yet scientific Text-book of Meteorology;" this puts its claims much higher; and from pages vi. and vii. we gather that Dr. Moore looks for many readers among his professional brethren and among medical officers of

health. We must, therefore, regard the book from that standpoint, and then we begin to see that it has a lack of balance. For example—more than a seventh of the whole book is devoted to an account of the history and present state of the United States Weather Bureau, occupying, with the appendix, more than 69 consecutive pages, while the work of the English Meteorological Office is dismissed in less than one-fifth of that space, and that of the Royal Meteorological Society and of the Scottish Meteorological Society seems to have only *six lines*. This notice of the United States Weather Bureau is actually longer than Part IV. (which we regard as the best in the book) dealing with "The Influence of Season and Weather on Disease," by a thoroughly skilled physician. There is in it only one point about which we are in doubt. Dr. Moore accepts (as most of his medical brethren have done) Dr. Edward Ballard's views as to the importance of records of the temperature of the soil at the depth of 4 ft. It may be; but we have already shown* that the dates of maximum and of minimum temperature of the soil are retarded in regular sequence about five days for each increase of one foot in depth; therefore, to say that any disease occurs a fortnight after the soil temperature at 4 ft. reaches any given point, is very much the same as saying that it does so 34 days after the air temperature has reached another given point.

We have already intimated that the book is pleasantly written and instructive; among matters upon which we differ with the author are on page 28, where he states that the service of Daily Weather Charts was inaugurated by Admiral FitzRoy in 1861, whereas the Admiral acted in consequence of a letter from M. Le Verrier (who had already started) to Sir G. B. Airy.

At the top of page 99 a few words have dropped out, the result being rather comic, although everyone can see what the Dr. means when he says (the italics are ours), "A thermometer consists of a capillary glass tube of uniform bore hermetically sealed at one end, and *blown at the other into a bulb filled with mercury or spirit.*"

On the same page under the (to us new) term "curing" the author refers to the old plan of storing thermometers for a year or so in order to lessen the error from the displacement of the zero point, but does not mention that by Denton's method this can now be done in as many days as it used to take months.

On page 103 he advises a vigorous treatment of Phillips's Maximum thermometer, which, though all very well for refractory specimens, would put first-class ones *hors de combat*.

On page 183 when speaking of atmometers (or as we should, perhaps incorrectly, prefer to say evaporators), Dr. Moore says "A manifest fault in these instruments is the exposure of the water in

* *Met. Mag.* xxvi. (1891) p. 130.

the evaporation dish to gusts of wind at all seasons and to frosts in winter." We do not understand wherein is the "fault;" surely an evaporator is to represent a natural water surface, and, if so, should neither be shielded from wind nor frost.

On page 149 Mr. Rogers Field appears as Assoc.I.C.E., he has been a full member for 17 years.

On page 230 it would have been as well to point out that Yeates's rain gauge is merely Crosley's modified to record electrically.

At foot of page 253 Dr. Moore gives an amusingly severe illustration of a very common error—happily dying out; he writes 4′ instead of 4^m; 4′ means four minutes of arc, the $\frac{1}{5400}$th of a circle, whereas what he wished to express was four minutes of time.

The foot-note on page 302 contains a curious slip which, at first, we could not make out. The work quoted contains xviii. & 261 = 279 pages, but the note says "16 pp.," it should have said "p. 16," which is quite another thing.

On page 303 the last sentence should either have been enlarged or printed as a foot note to the word "pipe" in the sixth l ne as it is, it may be supposed to contradict the previous sentence.

On page 374 we are sure that Dr. Moore will be glad to erase the word "Assistant" after the name of Dr. E. W. Hope, of Liverpool.

There is an amusing sentence which if the Anti-Tobacco Society is in existence may be useful to its members. On page 207 Dr. Moore says:—

> "The number of dust particles in the atmosphere is immense. "To take a single instance: Mr. Aitken states that a cigarette "smoker sends 4,000,000,000 particles, more or less, into the "air with every puff he makes."

We have finished our criticisms, and have to sum up the whole matter. Within the last few years we have had in English, and taking them in chronological order: Scott's *Elementary Meteorology* (International Scientific Series); Giberne's *The Ocean of Air*; the articles on Meteorology in Churchill's *Handbook of Hygiene* (Vol I.); Marriott's *Hints for Observers*; Waldo's *Modern Meteorology* (Contemporary Science Series); Dickson's *Meteorology* (University Extension Series); and Davis's *Elementary Meteorology*. It is such an *embarras de richesse* as never before fell to the lot of English-speaking meteorologists; we have already given notices of most of them in these pages, each has its weak points, and each—including Dr. Moore's—will teach the reader more than he can recollect.

We are glad to be able to add that the index is remarkably good, quite a feature in the book, and at present we have not detected a single error in it.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	5·01	XI.	Rhayader, Nantgwillt..	8·22
,,	Birchington, Thor	2·86	,,	Lake Vyrnwy	6·90
,,	Hailsham	4·54	,,	Corwen, Rhug	3·26
,,	Ryde, Thornbrough	7·08	,,	Carnarvon, Cocksidia ...	6·00
,,	Emsworth, Redlands ...	5·93	,,	I. of Man, Douglas	4·40
,,	Alton, Ashdell.....	6·04	XII.	Stoneykirk, Ardwell Ho.	2·04
III.	Oxford, Magdalen Col...	4·76	,,	New Galloway, Glenlee	8·06
,,	Banbury, Bloxham	3·66	,,	Melrose, Abbey Gate ...	2 60
,,	Northampton, Sedgebrook	3·18	XIII.	N. Esk Res. [Penicuick]	2·55
,,	Alconbury	2·87	,,	Edinburgh, Blacket Pl..	1·43
,,	Wisbech, Bank House..	2·85	XIV.	Glasgow, Queen's Park.	3·96
IV.	Southend	2·34	XV.	Inverary, Newtown	8·26
,,	Harlow, Sheering	2·65	,,	Islay, Gruinart School..	2·86
,,	Colchester, Lexden.....	2·97	XVI.	Dollar.....	3·26
,,	Rendlesham Hall	2·64	,,	Balquhidder, Stronvar..	8·62
,,	Diss	2·91	,,	Ballinluig	2·61
,,	Swaffham	4·26	,,	Dalnaspidal H.R.S. ...	6·56
V.	Salisbury, Alderbury...	5·93	XVII.	Keith H.R.S.	·60
,,	Bishop's Cannings	6·75	,,	Forres H.R.S.	·29
,,	Blandford, Whatcombe.	7·67	XVIII.	Fearn, Lower Pitkerrie.	...
,,	Ashburton, Holne Vic....	8·11	,,	Loch Shiel, Glenaladale	16·59
,,	Okehampton, Oaklands.	8·24	,,	N. Uist. Loch Maddy ...	7·36
,,	Hartland Abbey	7·68	,,	Invergarry	9·06
,,	Lynmouth, Glenthorne.	8·31	,,	Aviemore H.R.S.	1·31
,,	Probus, Lamellyn	8·38	,,	Loch Ness, Drumnadrochit	2·19
,,	Wellington, Sunnyside..	6·43	XIX.	Invershin	·72
,,	Wincanton, Stowell Rec.	6·83	,,	Scourie	4·15
VI.	Clifton, Pembroke Road	5·73	,,	Watten H.R.S.	·94
,,	Ross, The Graig	3·29	XX.	Dunmanway, Coolkelure	9·46
,,	Wem, Clive Vicarage ...	2·50	,,	Fermoy, Gas Works ...	4·71
,,	Cheadle, The Heath Ho.	2·26	,,	Killarney, Woodlawn ...	10·10
,,	Worcester, Diglis Lock	3·02	,,	Tipperary, Henry Street	4·37
,,	Coventry, Coundon	3·18	,,	Limerick, Kilcornan ...	3·74
VII.	Ketton Hall [Stamford]	3·13	,,	Ennis	...
,,	Grantham, Stainby	2·53	,,	Miltown Malbay.....	4·61
,,	Horncastle, Bucknall ...	2·09	XXI.	Gorey, Courtown House	4·22
,,	Worksop, Hodsck Priory	1·29	,,	Athlone, Twyford	3·49
VIII.	Neston, Hinderton	1·90	,,	Mullingar, Belvedere...	3·16
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	1·43
,,	Broughton-in-Furness..	7·50	XXII.	Galway, Queen's Coll...	...
IX.	Ripon, Mickley	1·69	,,	Crossmolina, Enniscoe..	7·12
,,	Scarborough, South Cliff	1·36	,,	Collooney, Markree Obs.	3·66
,,	East Layton [Darlington]	1·30	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	2·02	XXIII.	Lough Sheelin, Arley ..	2·61
X.	Haltwhistle, Unthank..	2·22	,,	Warrenpoint	2·62
,,	Bamburgh	·79	,,	Seaforde	2·32
,,	Keswick, The Beeches...	10·36	,,	Belfast, Springfield	2·26
XI.	Llanfrechfa Grange	5·91	,,	Bushmills, Dundarave...	2·25
,,	Llandovery	8·01	,,	Stewartstown	2·37
,,	Castle Malgwyn	6·01	,,	Buncrana	3·88
,,	Builth, Abergwessin Vic.	10·02	,,	Lough Swilly, Carrablagh	4·78

NOVEMBER, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATUR Max. Deg.	Date	Min. Deg.	D
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	2·85	+ ·19	·66	14	14	63·9	1	31·3	
II.		Maidstone (Hunton Court)...	3·71	+ ·78	·93	11	14	...	...	...	
,,		Strathfield Turgiss	5·36	+ 2·64	1·25	12	19	62·3	1	28·3	
III.		Hitchin	4·33	+ 1·65	1·37	12	16	61·0	1	28·0	
,,		Winslow (Addington)	4·36	+ 1·43	1·02	14	14	61·0	3	30·0	
IV.		Bury St. Edmunds (Westley)	2·49	— ·06	·70	12	11	59·0	3	33·0	
,,		Norwich (Brundall)	2·59	...	·78	12	19	61·4	3	29·6	
V.		Weymouth(LangtonHerring)	7·10	+ 3·44	1·50	11	18	60·0	3	35·0	
,,		Torquay (Cary Green)	7·71	...	2·03	11	19	60·5	1	39·0	
,,		Polapit Tamar [Launceston]..	7·56	+ 3·22	1·60	11	20	62·5	4	37·0	
VI.		Stroud (Upfield)	4·60	+ 1·27	·96	12	19	59·0	3	28·0	
,,		ChurchStretton(Woolstaston)	3·26	— ·26	·96	13	18	59·5	2	34·0	
,,		Tenbury (Orleton)	3·51	+ ·37	·92	12	18	63·4	2	31·0	
VII.		Leicester (Barkby)	1·97	— ·32	·67	12	14	66·0	1	23·0	
,,		Boston	2·41	+ ·21	·77	12	11	60·0	2	32·0	
,,		Hesley Hall [Tickhill].....	·98	— 1·04	·43	11	11	64·0	2	30·0	
VIII.		Manchester(PlymouthGrove)	...	...	...	...	...	...	...	...	
IX.		Wetherby (Ribston Hall) ...	1·40	— ·67	·46	14	15	...	...	...	
,,		Skipton (Arncliffe)	5·82	— ·93	1·64	13	20	...	...	...	
,,		Hull (PearsonPark)	1·55	— ·46	·54	12	9	62·0	2	32·0	
X.		Newcastle (Town Moor)	·71	— 1·69	·20	12	10	...	...	...	
,,		Borrowdale (Seathwaite).....	18·23	+ 3·44	3·58	1	23	...	...	...	
XI.	WALES.	Cardiff (Ely).....	5·14	+ ·23	·91	13	18	...	...	...	
,,		Haverfordwest	6·41	+ ·55	1·65	13	22	58·9	3	29·0	
,,		Aberystwith (Gogerddan) ...	4·77	— ·34	1·39	13	21	59·0	2, 3	21·0	
,,		Llandudno.....	2·71	— ·38	·79	13	22	63·8	1	33·8	
XII.	SCOTLAND.	Cargen [Dumfries]	6·33	+ 1·77	1·10	13	18	58·6	2	29·8	
,,		Jedburgh (Sunnyside).....	2·15	— ·35	·60	1	12	57·0	1	28·0	
XIV.		Colmonell	4·94	...	·74	13	19	61·0	...	24·0	
XV.		Lochgilphead (Kilmory).....	6·97	— ·32	·65	13	26	...	...	29·0	
,,		Mull (Quinish).....	9·17	+ 2·18	1·20	18	24	...	...	...	
XVI.		Loch Leven Sluices	3·30	— ·66	·40	2*a*	14	...	...	...	
,,		Dundee (Eastern Necropolis)	1·35	— 1·35	·45	13	14	58·7	2	28·9	
XVII.		Braemar	2·10	— 2·48	·58	13	18	54·7	1	21·0	
,,		Aberdeen (Cranford)	1·44	...	·30	18	17	60·0	2	25·0	
XVIII		Strathconan [Beauly]	3·01	— 3·55	·46	12	13	...	...	...	
,,		Glencarron Lodge.....	8·68	...	·97	13	26	57·8	3	28·9	
,,		Cawdor [Nairn]	·64	— 2·21	·16	13	11	...	...	...	
XIX.		Dunrobin	1·22	— 1·61	·27	9	10	56·0	8	31·0	
,,		S. Ronaldsay (Roeberry).....	1·50	— 1·92	·31	9	19	54·0	1	38·0	
XX.	IRELAND.	Darrynane Abbey.....	6·58	...	·93	13	22	...	...	...	
,,		Waterford (Brook Lodge) ...	4·94	+ 1·27	1·28	17	16	60·9	9	29·0	
,,		O'Briensbridge (Ross)	5·18	...	1·65	17	22	...	...	...	
XXI.		Carlow (Browne's Hill)	3·54	+ ·48	·74	13	17	...	...	...	
,,		Dublin (FitzWilliam Square)	1·48	— 1·35	·40	13	15	61·6	1	34·3	
XXII.		Ballinasloe	5·63	+ 1·72	1·61	17	25	58·0	1, 2	24·0	
,,		Clifden (Kylemore)	11·35	...	1·60	16	23	...	...	...	
XXIII		Waringstown	2·04	— 1·06	·38	4	17	61·0	3	24·0	
,,		Londonderry (Creggan Res.).	3·34	— 1·18	·34	6	26	...	...	...	
,,		Omagh (Edenfel)	3·28	— ·59	·50	17	21	61·0	1	25·0	

a And 5, 8, 14. *b* And 27. *c* And 26, 30. *d* And 30.

+*Shows* that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The first three weeks were very wet, the last ten days fair and frosty with little or no wind. The 13th and 14th were very tempestuous with heavy and continuous R, the Kennet and Lodden overflowed in many places, low-lying villages were flooded, and traffic on the Great Western Railway was greatly interrupted.

ADDINGTON.—With one exception the largest November rainfall in 24 years, with large floods on 12th, 13th and 14th, the exception being November, 1888, with 4·79 in. of R on 21 days. This November will be noted for the unusually high max. temp. at the beginning, and the general mildness throughout. Almost entire absence of fog. The max. shade temp. (61°) is the highest on record for November.

BURY ST. EDMUNDS.—A month almost without frost and with very little mist. Bar. very low on 13th. Water still short in West Suffolk. Sharp TS on the 12th.

NORWICH, BRUNDALL.—The mildest November since 1881, the temp. in shade rising above 60° on each of the first three days, and falling below 32° on only one night. At the close of the month chrysanthemums, geraniums and calceolarias still in flower in the garden. Mean temp. 46°·1. Floods on the marshes on 13th. Gale on 14th.

LANGTON HERRING—The rainfall was nearly twice the average, but no serious damage was done in this neighbourhood by the floods. In the 32 days ending on 20th 10·90 in. of R fell, the previous record for 32 days being 10·17 in. in December 1876 and January 1877. From 10th to 15th the weather was very stormy; the last ten days were cold and dry. L on 10th, 13th and 15th. Mean 9 a.m. temp. 2°·5 above the average.

TORQUAY, CARY GREEN.—Rainfall 3·73 in. above the average. Mean temp. 49°·5, or 3°·5 above the average. Duration of sunshine 74 hours, being 10 hours above the average; 10 sunless days.

POLAPIT TAMAR.—The total R for the month exceeds that of all previous Novembers since 1881 inclusive; prior to which the record here does not extend. On the 11th all rivers in the neighbourhood, particularly the Tamar, were higher than has ever been known within memory, and much damage was occasioned. From the 20th October to the 20th November (32 days) no less than 12·52 in. of R fell. This is a very abnormal amount when it is considered that about 37 in. is the annual average. The total amount for the last 11 months exceeds the annual average by ·48 in. The last 10 days of the month were dry and generally dull accompanied by cold winds from an easterly direction.

WOOLSTASTON.—The first three weeks were very wet, the last week fine but cold. A heavy gale occurred on the 13th, followed by extensive floods.

TENBURY, ORLETON.—The month opened with very warm damp weather, the temp. of the first week being much more like September than November. During the night of the 30th October the ther. reached 60°, and on the 2nd of November 63°·4, this being one of the highest maxima ever recorded in November. The weather up till the 20th was very wet, and a great flood occurred on the Teme on the 14th. From the 20th to the end of the month it was dry. Mean temp. of month 3°·7 above the average; very little frost or fog.

LEICESTER, BARKBY.—The first half of the month was wet, the second half dry, and water was still scarce. A pleasant month for November. Mean temp. 44°·1.

SEATHWAITE.—On the 1st 3·58 in. of R fell, on the 13th 2·90 in., on the 4th 2·28 in., on the 19th 1·60 in., and on the 7th 1·44 in.; on 7 other days the fall exceeded ·50 in.

WALES.

HAVERFORDWEST.—From the 23rd October to the 20th of this month, R fell almost continuously, the total in the 28 days amounting to 11·21 in. ; one of the wettest periods since January, 1849, when 11·00 in. fell. The weather was very mild and springlike, and very stormy from the 10th to the 15th. From the 24th to the end the air was drier and much colder, the temp. being low on several nights. A mild November.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout. Very mild for the first three weeks, but very little sunshine.

SCOTLAND.

CARGEN.—The first half of the month was very wet and stormy, and on three days (4th, 7th, and 13th) the fall exceeded an inch. The mean temp. of the month (45°·4) was 4° above the average, notwithstanding some cold weather during the latter half. On only two occasions during the last 35 years has the mean temp. of November been so high, viz., 1877, when it was 45°·6, and 1881, when it was 46°·6. Westerly winds prevailed for 25 days ; the hours of sunshine were considerably below the average. H on 11th. Gale on 13th. The R of the past 11 months is 44·93 in., the average for the period being 38·89 in.

JEDBURGH.—In the early part of the month R was frequent, but after the middle it was small. The atmosphere was still, and towards the end of the month there were some frosty nights, but the days were warm. Labour was not interrupted.

COLMONELL.—Mean temp. 45°·4. Gales on 13th and 17th.

BRAEMAR.—A fine, and on the whole, most favourable, month.

ABERDEEN, CRANFORD.—A wonderfully dry month.

ROEBERRY.—A very fine month upon the whole ; dry and quiet, with rainfall much below the average. Mean temp. 46°·6. The driest November recorded in 27 years ; the next driest was in 1885, when 1·66 in. of R fell.

IRELAND.

DARRYNANE ABBEY.—The first three weeks were wet, mild, and stormy ; the last few days dry, cold, and fine, with slight ground frosts at night.

WATERFORD, BROOK LODGE.—The month was so mild that many flowers were blooming at the close, and peas were gathered as late as the 30th. S.W. gales on 7th and 17th. Heavy W. to S.W. gale on 14th. Large lunar halo on 12th.

O'BRIENSBRIDGE, ROSS.—Heavy and continued R for the first three weeks. Heavy gales from 14th to 20th. Dense fog on 27th and 28th. Slight frost on 29th. Sharp frost on 30th.

DUBLIN.—An open, generally favourable month. The first half was unsettled, squally, and showery ; the second half was mild, quiet, often cloudy, and foggy. Only once in the last 30 years has November been milder than in the present year—that was in 1881, when the mean temp. was as high as 50°·3, or 5°·6 above the average. Mean temp. 47°·8, 3°·1 above the average. High winds on 15 days, attaining the force of a gale on 5th and 13th. Foggy on six days. Solar halo on the 4th. Lunar halo on 5th and 11th. L on 15th. Aurora borealis on the 23rd.

EDENFEL.—Up to the 22nd the weather was mild, rainy, and unsettled, culminating in a gale on the 13th, but without any of the extremes of violence or amount of rainfall that have wrought such havoc in England. From the 16th a progressive improvement took place, with eight days of rainless weather from the 22nd to the end, and generally bright, pleasant skies, and no frost of consequence.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

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(Savilian Professor of Astronomy.)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Roya Meteorological Societies, and of the British Astronomical Association; Article by various eminent Astronomers, English, American, and Continental Correspondence on topics of interest connected with the Science; Notices o Observatories, Publications and current Discoveries. Notes on Meteors, o Variable Stars, on Lunar Formations, etc., also are supplied for the assistanc and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuab publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

All communications should be addressed to the Editors of "The Observatory" Royal Observatory, Greenwich, S.E.

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SYMONS'S
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Francois Denza.

Naples,
June 7th, 1834.

Rome,
December 15th, 1894.

PEACEFULLY, suddenly, in the middle of his labours, yet having lived to see the completion of his crowning work—the establishment of the Observatory at the Vatican,—Padre Denza has passed away. Like his teacher (Padre Secchi) he has left a name which will not soon be forgotten. Far from robust in health, Padre Denza's exhaustless energy enabled him to turn out a very large amount of work, the books and pamphlets issued by him numbering nearly 100, while his kindness to all whom he could help was practically unbounded.

THE GALE OF SATURDAY, DECEMBER 22ND.

IT has been arranged that Mr. Charles Harding will read a paper upon the above storm at the meeting of the Royal Meteorological Society on January 16th, and, therefore, as we have always opposed duplicate work as generally a waste of energy, we have sent on to him such data as we have received, and we intend, in the ordinary course, to summarize his paper in our next.

There was, however, one remarkable feature, respecting which a few particulars may be given here. Nearly 30 years ago—in *British Rainfall*, 1866, page 11—to an article on "The Detection of Sea-spray when mingled with Rain," we appended the following foot-note:—"Dr. Davy, F.R.S., says: 'I have been informed by a friend residing at Meltham Parsonage, and by another residing at Armitage Bridge, both places in the neighbourhood of Huddersfield, and about 80 miles from Scarborough, and 60 miles from Liverpool (the nearest ports of the opposite coasts), that after the great storm of January, 1839, salt was observed deposited on the leaves of the trees at both places; they were about 4 miles apart.'"

Liverpool has had another storm; not equal to that of 1839, but (as we can testify from personal experience) a very heavy one, and again the salt has been traced considerably more than half across England. However, we must not anticipate, but give our evidence:—

Salt-spray and Severe Gales.

To the Editor of the Meteorological Magazine.

Sir,—As evidence of the large amount of salt-spray carried inland from the sea during the severe gales, the following may be of interest:—Whilst staying in the neighbourhood of Garstang, Lancashire, I noticed, on December 23rd last (the day after the violent gale), that all objects—such as the twigs and branches of trees, plants, grass &c., tasted very strongly of salt. The following morning a fine drizzle set in, and about 9 a.m., when less than ·01 in. of rain had fallen, I collected, by means of a teacup, rather over an ounce of water from the drops on the twigs and branches of apple trees. One fluid ounce of this water, which tasted strongly of brine, and had a specific gravity of 1·059, gave (on evaporation) 38 grains of *dry* salt. This is equal to 6,080 grains, or nearly 14 ounces per gallon.

The gale of December 22nd blew first from the S.W. and W., and afterwards veered to the N.W. The distance from the sea to the place where I collected the drops is about 13 miles from the former points (Lytham and Blackpool), and 7 miles from the latter (the coast near Pilling).

I may mention that during a walk on December 23rd I noticed that the stems of rushes and grass in Bleasdale, about 4 miles further from the sea, did not taste appreciably less salty.

I enclose herewith, for your inspection, *half* of the salt obtained from one ounce of water.—Yours sincerely,

ALBERT WILSON.

20, *Merton Road, Bradford, December* 31*st*, 1894.

We sent the little bottle of salt on to Prof. Meldola, F.R.S., who very kindly had it analysed, the result being that it was almost precisely identical with sea-salt, chiefly, of course, chloride of sodium, with magnesium, and decidedly more sulphates than are usually found in sea-salt. The actual quantity of chlorine found was 60·7 per cent. (calculated for the salt when dried till constant in weight), corresponding to 87·2 per cent. of sodium chloride. Here then, about 10 miles inland, we have dripping from the trees brine of nearly twice the usual specific gravity of sea-water; what weight of salt, or how much sea-water, per acre this represents we do not attempt to compute.

We now come to the other aspect of the case—extreme distance inland at which it was detected,—and here we are almost entirely dependent upon one of our most careful observers, who sent the following letter to a local paper:—

The Brine in the Gale.

To the Editor of The Yorkshire Post.

Sir,—During the severe gale last Saturday morning salt was deposited by the rain on the windows of this house, which face in a westerly direction. The amount was afterwards estimated

by an experienced chemist, and found to be about one-hundredth of a gramme per square foot of glass. Perhaps some of your readers would estimate how much was deposited over the country between here and the Irish Sea, a distance of about 45 miles.

I am, yours truly,

CHARLES L. BROOK.

Harewood Lodge, Meltham, Yorkshire, December 24th.

This letter elicited reports as to the detection of salt from Settle (24), Sowerby Bridge (40), Bolton Abbey (42), Harrogate (50), East Ardsley, Wakefield (57), Bramhope (60), and Burton House, Masham (65) miles from the west coast. The above distances are only approximate, but roughly they cover an area of nearly 2,500 square miles, and reach eastward to Long., 1°30′ W. Saline incrustation 25 miles inland is recorded on p. 169 of Vol. xxiii. of this *Magazine*, and there is a long article on "Sea-spray in London," on pp. 65–70 of Vol. xvii. It seems indisputable that sea-spray can be carried from 60 to 70 miles inland.

Since writing the above, we learn from two sources that objects near Birmingham were encrusted with salt. Birmingham is about 55 miles from the Bristol Channel, and nearly 100 from Cardigan Bay.

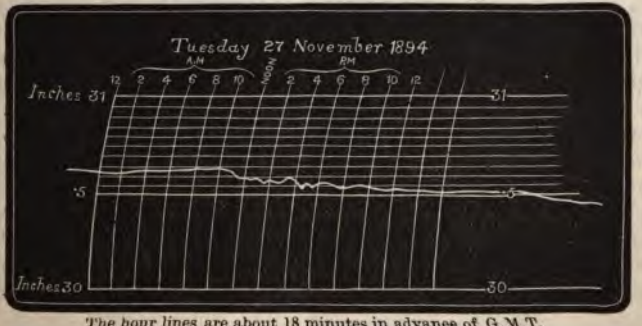
BAROMETRIC OSCILLATIONS IN CALM WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—On the afternoon of Nov. 27th the barometer, as shown by the barograph trace, became very greatly disturbed; yet there was not the slightest perceptible effect upon the weather. The trace had been very steady for two or three days, with dull, calm, weather; and there was no observable change in this weather during the time the barometer was so much excited, except that such wind as there was changed from E. through S. to W., but there was almost a dead calm all the time. I send a fairly correct copy of the barograph trace, which shows a fall of ·07 in. in about three-quarters of an hour, besides minor irregularities.

T. W. BACKHOUSE.

Sunderland, December 4th, 1894.



The hour lines are about 18 minutes in advance of G.M.T.

REVIEW.

Ostwald's 'Klassiker der exakten Wissenschaften' herausgegeben von Prof. Dr. A. von OETTINGEN.

No. 53. **C. F. Gauss,** Die intensität der erdmagnetischen Kraft auf absolutes Maass zurückgeführt. In der Sitzung der Kgl. Gesellschaft der Wissenschaften zu Göttingen am 15. December 1832 vorgelesen. Herausg. v. E. DORN. (62 pages.)

No. 57. **Fahrenheit, Réaumur, Celsius,** Abhandlungen über Thermometrie. (1724, 1730—1733, 1742.) Herausgegeben von A. J. v. OETTINGEN. With 17 engravings. (140 pages.)

No. 59. **Otto von Guericke's** Neue "Magdeburgische" Versuche über den leeren Raum. (1672.) Aus dem Lateinischen übersetzt und mit Anmerkungen herausg. von FRIEDRICH DANNEMANN. With 15 engravings (116 pages.)

Leipzig: Wilhelm Engelmann, 1894, 8vo.

IT would be hard to find an English publisher who would bring out a series of such capital little books as these, with red edges, rounded corners and durable cloth covers at prices ranging from 1s. to 2s. 4d. We do not know the relative number of persons in the world who speak English and who speak German, but we are quite certain that the Germans who will read and enjoy books of the above type must be tenfold or a hundredfold that of the Britishers (including India, Australia and Canada) and Americans, or else Herr Engelmann would not have reached No. 59 of this remarkable series. Questions of education, of culture, of social habits, and of politics are altogether foreign to these pages, but if Englishmen wish to hold their own they will certainly have to make some changes.

No. 53 is a translation of the celebrated memoir by Gauss "Intensitas vis magneticæ terrestris ad mensuram absolutam revocata," read by him before the Scientific Society of Göttingen, on December 15th, 1832. It has always been regarded as having been —not merely of the highest importance—a sort of foundation-stone to the study of terrestrial magnetism, determining as it does exactly with what force the earth pulls a compass needle, but also as leading to the accurate determination of many other physical constants.

No. 57 is of extreme interest to meteorologists; it contains the original papers which led to the introduction of the three leading thermometer scales, with reproductions of the original engravings. There are five papers by Fahrenheit, translated from the *Philosophical Transactions* for 1724; there are the Rules for the construction of Thermometers with comparable scales, and two other papers, by R. A. Ferchault de Réaumur, from the *Hist. et Mém. de l'Acad. de Paris*, 1730, 1731 and 1733; and there is Celsius's paper on "Two fixed points for Thermometers," from the *Abh. d. schewdischen Akad.*, 1742; lastly in this (as also in the two other works) there are

12 pages of "Remarks" upon points raised by the papers. If we ever have a fuller history of the thermometer than that given some years since by M. Renou, the compiler must not overlook this No. 57, upon which we wish that we had time to linger longer.

No. 58. This is a translation (with excellent—reduced—reproductions of the engravings) of the third book of Otto de Guericke's *Experimenta Nova* (*ut vocantur*) *Magdeburgica de Vacuo Spatio*, Amsterdam, 1672. Here we have not only full details of the first air-pump and of the Magdeburg hemispheres, but also perfect reproductions of the portrait, the title-page, the celebrated two-page plate of the 16 horses trying to separate the hemispheres, in fact all the most important portions of that epoch-making, and now rather scarce, book—and all for two shillings; why the pictures alone are worth that, even to those who cannot read German.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of the session was held on Wednesday evening, the 21st November, at the Institution of Civil Engineers, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Dr. H. B. Guppy read a paper on "Suggestions as to the methods of determining the influence of Springs on the temperature of a River, as illustrated by the Thames and its tributaries." The methods suggested were :—1. Comparison of the curves of the monthly means of the temperatures of the air and of the water for the river under observation with those of a river beyond the controlling influence of springs. 2. Comparison of the monthly means of the temperature of the river under investigation with that of a river beyond the control of the springs. 3. Comparison of the range of the monthly means of the river temperature with that of the air in the shade. 4. Comparison of the daily range of water temperature at different stations along a river's course. 5. Comparison of sunrise observations made at different stations along a river's course. 6. Comparison of observations made at different stations along a river's course at the hour of maximum temperature. 7. Comparison of the results obtained from a single series of observations made in one day along the whole course of a small tributary like the Wandle, or along the upper course of a larger tributary, as the Kennet. 8. Determination of the distance from its sources at which the river begins to freeze.

Mr. Eric S. Bruce, F.R.Met.Soc., exhibited and described some lantern photographs showing the disastrous effects of the great gale of November 17th and 18th, 1893, upon trees in Perthshire, Scotland.

Mr. Alfred B. Wollaston gave an account of the formation of some waterspouts which he had observed in the Bay of Bengal.

THE monthly Meeting of this Society was held on Wednesday, December the 19th, at the Institution of Civil Engineers, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Twenty-six new Fellows were elected.

Mr. R. H. Scott, F.R.S., gave an account of the proceedings of

the International Meteorological Committee, at Upsala, in August last, with special reference to their recommendations on the classification of clouds and the issue of a Cloud Atlas.

The classification adopted is as follows:—

a. Separate or globular masses (most frequent in dry weather).

b. Forms which are widely extended, or completely cover the sky (in wet weather).

A. UPPER CLOUDS, average altitude 9,000 m. (29,528 ft.).

a. 1. Cirrus.

b. 2. Cirro-stratus.

B. INTERMEDIATE CLOUDS, between 3,000 m. (9,842 ft.) and 7,000 m. (22,966 ft.).

a. { 3. Cirro-cumulus.
   { 4. Alto-cumulus.

b. 5. Alto-stratus.

C. LOWER CLOUDS, between 1,000 m. (3,281 ft.) and 2,000 m. (6,562 ft.).

a. 6. Strato-cumulus.

b. 7. Nimbus.

D. CLOUDS OF DIURNAL ASCENDING CURRENTS.

8. Cumulus; apex 1,800 m. (5,906ft.); base 1,400 m. (4,593ft.)

9. Cumulo-nimbus; apex 3,000 m. (9,842 ft.) to 5,000 m. (16,405 ft.); base 1,400 m. (4,593 ft.)

E. HIGH FOGS, under 1,000 (3,281 ft.).

10. Stratus.

DEFINITIONS.

1. CIRRUS (Ci.) *Detached clouds, delicate and fibrous looking, taking the form of feathers, generally of a white colour.*

2. CIRRO-STRATUS (Ci-S.). *A thin, whitish sheet.*

3. CIRRO-CUMULUS (Ci-Cu.). *Small globular masses or white flakes without shadows, or having very slight shadows, arranged in groups, and often in lines.*

4. ALTO-CUMULUS (A.-Cu.). *Largish globular masses, white or greyish, partially shaded, arranged in groups or lines, and often so closely packed that their edges appear confused.*

5. ALTO-STRATUS (A.-S.). *A thick sheet of a grey or bluish colour.*

6. STRATO-CUMULUS (S.-Cu.). *Large globular masses or rolls of dark cloud, frequently covering the whole sky, especially in winter.*

7. NIMBUS (N.) RAIN-CLOUD. *A thick layer of dark clouds, without shape, and with ragged edge.*

8. CUMULUS (Cu.) WOOLPACK CLOUDS. *Thick clouds, of which the upper surface is dome-shaped and exhibits protuberances, while the base is horizontal.*

9. CUMULO-NIMBUS (Cu.-N.). THE THUNDER-CLOUD; SHOWER-CLOUD. *Heavy masses of cloud, rising in the form of mountains, turrets, or anvils, generally having a sheet or screen of fibrous appearance above ("false Cirrus"), and underneath a mass of cloud similar to Nimbus.*

10. STRATUS (S.). *A horizontal sheet of lifted fog.*

Each definition was supplemented by a few lines of explanation

giving additional characteristics and variations, and the paper concluded with the instructions for observing clouds, in which the observer is instructed to estimate the density of Cirrus on a scale of 0 to 4.

Before the discussion of the paper Mr. Gaster exhibited and explained some very beautiful lantern photographs of typical cloud-forms, and expressed general concurrence with the recommendations of the Committee.

Captain Wilson Barker asked if the altitudes given for the different clouds referred to all latitudes, or only to Europe, and suggested that there would be some difficulty in judging the density of Cirrus. From his own observation he thought that some clouds developed upwards and some downwards, and the classification of the International Committee made no reference to this. He also considered it too limited, and preferred that given by the Rev. Clement Ley in his recent work.

The Hon. Rollo Russell asked whether the altitudes given indicated the extreme maxima and minima, or gave the range commonly observed.

Mr. Jackson spoke of the varied forms which clouds assume in different localities, and asked for an explanation of the variation of form between, say, the Highlands of Scotland and the Isle of Thanet.

Mr. Charles Harding spoke in appreciative terms of the classification, and thought it would be very helpful to sailors in cloud observations. One reason for which he valued it was that it did not introduce a great increase in Luke Howard's nomenclature. He was sorry to hear that Captain Wilson Barker preferred Mr. Ley's classification. The International Committee were men who spoke with great authority, and he would like their names to appear at the head of the paper.

Mr. J. G. Wood referred to the difficulty of taking photographs of cloud, and said that he thought that it would be very useful if instruction were given as to the best methods.

Mr. Gate Acres spoke on photographic details, and Mr. R. H. Scott briefly replied to the discussion.

Mr. H. Southall, F.R.Met.Soc., read a paper on "Floods in the West Midlands," in which he gave an interesting account of the great floods which have occurred in the rivers Severn, Wye, Usk, and Avon. He has collected a valuable record of the floods on the Wye at Ross, which he arranges in three classes, viz.: Primary, or highest of all, those of 14 ft. 6 in. and above; Secondary, those of 12 to 14½ ft.; and Tertiary, those of 10 to 12 ft. The dates of the floods above 14 ft. 6 in. are as follows: 1770, Nov. 16th and 18th; 1795, Feb. 11th and 12th; 1809, Jan. 27th; 1824, Nov. 24th; 1831, Feb. 10th; 1852, Feb. 8th and Nov. 12th. The height of the recent flood on Nov. 15th, 1894, was 14 ft. 3 in., which was higher than any flood since Nov., 1852. The flood on the Avon, at Bath, on Nov. 15th, 1894, is believed to have been the highest on record.

Mr. Symons urged the importance of permanently recording the height of floods, but owing to the late hour no discussion followed.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	83·8	30	43·7	12	68·9	50·6	50·0	74	125·9	36·6	1·84	12	5·9
Malta	89·3	27	55·8	18	79·6	62·7	60·4	71	141·5	50·0	·00	0	2·0
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	76·3	15	56·8	11	74·4	61·8	57·6	71	126·6	44·6	·76	10	4·3
Calcutta	96·9	2	72·4	8	90·1	78·2	78·6	84	156·6	72·1	10·23	18	7·1
Bombay	93·0	1	74·5	11	87·4	79·7	77·4	82	142·5	73·4	16·87	21	8·2
Ceylon, Colombo	86·7	9	73·8	...	85·0	77·0	75·5	80	152·0	70·0	11·32	24	8·0
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	64·3	19	40·3	29	60·5	46·4	47·4	84	122·0	33·4	2·23	14	5·2
Sydney	65·9	2	42·3	30	61·3	48·2	44·4	83	111·0	29·8	1·42	10	3·8
Wellington	60·1	14	36·5	26	55·3	46·4	44·1	79	101·0	24·0	5·93	20	5·6
Auckland	65·0	4	37·5	26	60·0	48·9	47·0	75	119·0	30·0	4·12	21	6·1
Jamaica, Kingston	92·9	22	71·1	8	88·3	73·1	71·6	75	...	...	·70	6	3·9
Grenada	86·5	29	72·0	18*a*	83·7	74·4	68·9	73	151·0	...	4·30	22	4·0
Trinidad	94·0	16	66·0	25	89·5	69·6	69·6	73	166·0	61·0	3·26	12	...
Toronto	90·7	26	57·9	7	76·4	56·9	57·6	75	...	31·0	1·08	15	5·1
New Brunswick, Fredericton	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	92·2	14	32·0	5	82·2	54·2	...	...	...	...	2·40	11	4·8
British Columbia, Esquimalt	77·2	2	44·2	1	63·6	48·7	49·2	80	...	...	2·37	14	5·6

a And 20, 24.

REMARKS.

MALTA.—Adopted mean temp. 70°·5; mean hourly velocity of wind 7·9 miles per hour. Temp. of sea rose to 74°·7. A passing shower gave a few drops of rain on 13th, but not enough to measure. J. F. DOBSON.

Mauritius.—Mean temp. of air 2°·2, of dew point 2°·9, and rainfall 1·24 in. below, their respective averages. Mean hourly velocity of wind 9·6 miles, or 1·8 miles below average; extremes, 27·6 on 28th, and 0·0 4th; prevailing direction, S.E. by S. to E.S.E. C. MELDRUM, F.R.S.

Adelaide.—Mean temp. above, and mean pressure slightly below, the average of 37 years. Rainfall over half-an-inch less than the average. Fair rains in the south, but still dry all over the north, especially over the interior. C. TODD, F.R.S.

Sydney.—Temp. 0°·4 above, humidity 4·7 above, and rainfall 4·07 in. below, their respective averages. Winter unusually fine, dry and mild. H. C. RUSSELL, F.R.S.

Wellington.—On the whole a wet month, with only a few fine days in the middle. Prevailing winds S.E. and N.W. Stormy on three days from the former, and two days from the latter, quarter. Mean temp. 1°·8 above the average. R. B. GORE.

Auckland.—A showery and unpleasant month, but with no storms of exceptional violence, or unusually heavy rainfall. Mean temp. slightly above the average; rainfall slightly below. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 5·1 miles. Weather fair in Kingston, with only a sixth of the average rainfall. In every division the fall was deficient, the mean being less than one-half the average. For the half-year, however, the island rainfall was two inches in excess of the average, the deficiencies in January and June being more than counterbalanced by the excess in May. R. JOHNSTONE.

TRINIDAD.—Rainfall 4·78 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1894.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·43	XI.	Rhayader, Nantgwillt..	6·56
,,	Birchington, Thor	1·43	,,	Lake Vyrnwy	7·51
,,	Hailsham	2·40	,,	Corwen, Rhug	2·14
,,	Ryde, Thornbrough	2·51	,,	Carnarvon, Cocksidia ...	3·91
,,	Emsworth, Redlands ...	2·34	,,	I. of Man, Douglas	5·75
,,	Alton, Ashdell.....	3·29	XII.	Stoneykirk, Ardwell Ho.	2·88
III.	Oxford, Magdalen Col...	1·95	,,	New Galloway, Glenlee	6·59
,,	Banbury, Bloxham	2·41	,,	Melrose, Abbey Gate ..	2 65
,,	Northampton, Sedgebrook	1·92	XIII.	N. Esk Res. [Penicuick]	3·45
,,	Alconbury	1·27	,,	Edinburgh, Blacket Pl..	2·25
,,	Wisbech, Bank House..	1·56	XIV.	Glasgow, Queen's Park.	2·97
IV.	Southend	1·75	XV.	Inverary, Newtown	6·35
,,	Harlow, Sheering	2·70	,,	Islay, Gruinart School..	1·56
,,	Colchester, Lexden.....	1·55	XVI.	Dollar.....	3·39
,,	Rendlesham Hall	2·44	,,	Balquhidder, Stronvar..	8·62
,,	Diss	2·80	,,	Balliuluig	3·18
,,	Swaffham	3·05	,,	Dalnaspidal H.R.S. ...	7·16
V.	Salisbury, Alderbury...	2·68	XVII.	Keith H.R.S.	1·68
,,	Bishop's Cannings	2·73	,,	Forres H.R.S.	1·36
,,	Blandford, Whatcombe.	3·74	XVIII.	Fearn, Lower Pitkerrie.	2·04
,,	Ashburton, Holne Vic....	3·36	,,	Loch Shiel, Glenaladale	11·57
,,	Okehampton, Oaklands.	4·12	,,	N. Uist. Loch Maddy ...	5·58
,,	Hartland Abbey	4·31	,,	Invergarry	8·21
,,	Lynmouth, Glenthorne.	3·65	,,	Aviemore H.R.S.	3·25
,,	Probus, Lamellyn	4·29	,,	Loch Ness, Drumnadrochit	4·97
,,	Wellington, Sunnyside..	2·78	XIX.	Invershin	2·64
,,	Wincanton, Stowell Rec.	3·16	,,	Scourie	5·85
VI.	Clifton, Pembroke Road	2·97	,,	Watten H.R.S.	2·14
,,	Ross, The Graig	1·84	XX.	Dunmanway, Coolkelure	6·86
,,	Wem, Clive Vicarage ...	2·49	,,	Fermoy, Gas Works ...	2·76
,,	Cheadle, The Heath Ho.	2·56	,,	Killarney, Woodlawn ...	6·06
,,	Worcester, Diglis Lock	1·85	,,	Tipperary, Henry Street	3·38
,,	Coventry, Coundon	2·68	,,	Limerick, Kilcornan ...	2·16
VII.	Ketton Hall [Stamford]	1·97	,,	Ennis	...
,,	Grantham, Stainby	1·42	,,	Miltown Malbay.....	3·90
,,	Horncastle, Bucknall ...	1·94	XXI.	Gorey, Courtown House	3·01
,,	Worksop, Hodsck Priory	1·39	,,	Athlone, Twyford	3·28
VIII.	Neston, Hinderton	2·07	,,	Mullingar, Belvedere ...	3·58
,,	Lancaster, Rose Bank...	...	,,	Longford, Currygrane...	3·09
,,	Broughton-in-Furness..	6·77	XXII.	Galway, Queen's Coll...	...
IX.	Ripon, Mickley	2·58	,,	Crossmolina, Enniscoe..	6·72
,,	Scarborough, South Cliff	...	,,	Collooney, Markree Obs.	4·86
,,	East Layton [Darlington]	1·88	,,	Ballinamore, Lawderdale	4·01
,,	Middleton, Mickleton..	3·03	XXIII.	Lough Sheelin, Arley ..	2·76
X.	Haltwhistle, Unthank..	2·87	,,	Warrenpoint	4·02
,,	Bamburgh.....	1·39	,,	Seaforde	3·65
,,	Keswick, The Beeches...	7·10	,,	Belfast, Springfield	3·88
XI.	Llanfrechfa Grange	4·03	,,	Bushmills, Dundarave...	4·68
,,	Llandovery	5·34	,,	Stewartstown	3·01
,,	Castle Malgwyn	3·63	,,	Buncrana	4·18
,,	Builth, Abergwessin Vic.	7·14	,,	Lough Swilly, Carrablagh	4·80

DECEMBER, 1894.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	2·28	+ ·21	·93	14	16	52·1	17*c*	26·3	31
II.		Maidstone (Hunton Court)...	1·36	— ·88	·27	7	14	...	...	...	...
,,		Strathfield Turgiss	2·61	+ ·60	·97	14	19	53·8	12	26·1	31
III.		Hitchin	1·52	— ·51	·60	14	16	51·0	17	26·0	30
,,		Winslow (Addington)	2·09	— ·36	·48	14	18	53·0	13	25·0	1
IV.		Bury St. Edmunds (Westley)	2·29	+ ·05	·63	14	17	51·0	24	26·0	31
,,		Norwich (Brundall)	3·03	...	·58	14	19	51·2	18	28·4	6
V.		Weymouth(LangtonHerring)	2·14	— ·96	·43	11	19	53·0	14	28·0	31
,,		Torquay (Cary Green)	2·21	...	·51	14	20	54·1	14*d*	29·3	31
,,		Polapit Tamar [Launceston]..	3·61	— ·62	·47	14	23	55·0	2	31·5	31
VI.		Stroud (Upfield)	2·64	+ ·19	·50	14	18	57·0	13	27·0	5
,,		ChurchStretton(Woolstaston)	2·47	— ·58	·45	23	16	52·0	13	25·0	31
,,		Tenbury (Orleton)	1·89	— ·48	·34	14	15	55·0	17	25·7	1
VII.		Leicester (Barkby)	2·26	+ ·12	·67	14	17	54·0	13	23·0	31
,,		Boston	1·16	— ·69	·42	14	13	50·0	16	27·0	31
,,		Hesley Hall [Tickhill].....	1·29	— ·69	·27	14	13	53·0	13	25·0	2
VIII.		Manchester(PlymouthGrove)	2·79	— ·65	·40	17	20	53·0	13	26·0	31
IX.		Wetherby (Ribston Hall) ...	1·47	— ·97	·36	22*a*	11	...	...	...	...
,,		Skipton (Arncliffe)	7·90	+ 1·09	1·42	17	18	...	...	...	...
,,		Hull (PearsonPark)	2·58	+ ·31	·38	11*i*	14	53·0	13*e*	26·0	2
X.		Newcastle (Town Moor)	1·29	— 1·01	·28	14*b*	11	...	...	...	...
,,		Borrowdale (Seathwaite).....	13·42	— 1·39	2·32	21	20	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	...	...	...	...	...	...	...	...	...
,,		Haverfordwest	5·16	+ ·17	·70	30	25	54·0	12*f*	22·9	4
,,		Aberystwith (Gogerddan) ...	4·57	— ·31	·86	14	17	52·0	11*g*	18·0	3
,,		Llandudno.....	2·64	— ·32	·48	17	21	58·5	18	30·6	4
XII.	SCOTLAND.	Cargen [Dumfries]	4·50	+ ·48	1·24	21	15	53·4	14	26·4	31
,,		Jedburgh (Sunnyside).....	1·90	— ·30	·52	21	15	53·0	13	23·0	3
XIV.		Colmonell	5·09	...	·81	21	18	54·0	13	20·0	3
XV.		Lochgilphead (Kilmory).....	6·49	— ·88	·73	21	23	...	...	24·0	30
,,		Mull (Quinish).....	5·80	— 1·77	·80	22	21	...	...	...	...
XVI.		Loch Leven Sluices	3·10	— ·21	·70	22	13	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·90	— ·18	·45	21	20	55·0	13	28·0	30
XVII.		Braemar	4·21	+ 1·74	·80	21	17	50·0	13	15·8	4
,,		Aberdeen (Cranford)	2·68	...	·52	30	20	54·0	12	25·0	1,
XVIII		Strathconan [Beauly]	7·99	+ 2·22	1·95	13	15	...	...	...	...
,,		Glencarron Lodge.....	12·99	...	1·59	21	25	57·0	11	24·1	12
,,		Cawdor [Nairn]	2·47	+ ·01	·65	28	19	...	...	...	...
XIX.		Dunrobin	2·91	— ·46	·43	21	16	56·0	13	28·5	17
,,		S. Ronaldsay (Roeberry).....	2·68	— ·98	·49	21	29	52·0	13	28·0	31
XX.	IRELAND.	Darrynane Abbey.....	5·29	...	·89	9	26	...	...	...	...
,,		Waterford (Brook Lodge) ...	3·35	— ·29	·68	9	16	53·5	13*h*	27·0	31
,,		O'Briensbridge (Ross)	5·48	...	·69	6	22	...	...	...	...
XXI.		Carlow (Browne's Hill)	2·50	— ·62	·48	21	16	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·51	— ·65	·22	23	18	56·8	13	27·9	31
XXII.		Ballinasloe	3·56	+ ·14	·52	21	22	53·0	13	21·0	2
,,		Clifden (Kylemore)	10·58	...	2·14	9	26	...	...	...	...
XXIII		Waringstown	2·66	— ·38	·36	21	21	55·0	13*k*	22·0	3
,,		Londonderry (Creggan Res.).	4·82	+ ·61	·77	29	28	...	...	...	...
,,		*Omagh (Edenfel)*	3·95	+ ·27	·53	9	24	53·0	10	25·0	30

a And 29. *b* And 28. *c* And 18. *d* And 16. *e* And 14. *f* And 14, 25. *g* And 12. *h* And 17. *i* And 31. *j* And 30, 31 *k* And 23.

+ *Shows that the fall was above the average ;* —*that it was below it.*

METEOROLOGICAL NOTES ON DECEMBER, 1894.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—December commenced with a very cold snap, the grass min. falling to 22°·6, and after a very mild middle course, ended with another low temp, 19°·3 on the grass. Considerable disturbance on the 22nd, but not amounting to a gale. First wild primrose seen on 8th.

ADDINGTON.—A very open month, the most severe frosts (of almost equal intensity) occurring on the 1st and 31st. Very high wind on the 18th, 22nd, 28th and 29th. The first S of the season fell on the evening of the 29th, and on the morning of the 30th the north side of the Quainton Hills showed white, but little lay on the low lands. Only one foggy day—the 9th. Brook flooded on the 15th.

BURY ST. EDMUNDS.—A mild, windy month, with no winter till the 28th, then S and high winds; the S was much drifted on the morning of January 1st, 1895. Violent oscillation of the bar. from the 19th to the end of the month. Fog on 5th and 8th.

NORWICH, BRUNDALL.—Very mild, and hardly any frost. No S till 30th, on which day and the following there was a heavy fall, amounting to ·97 in. when melted. Violent S. to W. gale on 22nd, and a fresh gale on 29th. Solar halo on the morning of the 7th. The whole valley of the Yare like a vast lake on 23rd.

LANGTON HERRING.—The mean temp. at 9 a.m., 41°·8, is 2°·1 above the average. Owing to the mild weather of the last two months, the fields have quite a spring-like appearance. There was a thick fog on the 14th; a great storm on the night of the 21st and 22nd, and heavy gales on the 29th and 30th.

TORQUAY, CARY GREEN.—Rainfall 1·01 in. below the average. Mean temp. 45°·5, or 3°·9 above the average. Duration of sunshine 73 hours 10 min., being 15 hours 45 min. above the average; 10 sunless days.

POLAPIT TAMAR.—Generally a damp, unseasonable, warm month, with less than the usual amount of sunshine. S 2½ inches deep on 31st.

STROUD, UPFIELD.—T and L at 11.30 a.m. on 19th. W. to N.W. gale on 21st and 22nd.

WOOLSTASTON.—A mild and warm month till the last few days, when it became very cold; S falling on the 29th. Slight frosts on grass most nights. Mean temp. 40°·6. Gales on 21st, 22nd and 29th. A wild duck's nest with several eggs in it was found on 24th.

TENBURY, ORLETON.—An unusually warm month—in fact, with two exceptions, the warmest month of December in the last 20 years. Great gales on the 22nd and 29th. S on the 29th, covering the ground to a depth of 2½ inches on the 30th. Fog on 7 days. Temp. 2°·8 above the average.

LEICESTER, BARKBY.—A fine month, the first and last weeks being the coldest. Mean temp. 39°·8. Very strong winds on the 21st, 28th and 29th. First S on 29th, very slight.

WALES.

HAVERFORDWEST.—December commenced cold, notably the first four days, the exposed ther. on the 4th falling to 19°; it continued cold to the 10th; a very wet and mild period then set in, which lasted to the 18th, when the air again became colder, and stormy, broken weather set in, which culminated in a fierce gale, commencing from S.W., and veering to W. and N. From the 21st until the 26th continuous R fell, and another strong gale followed on 29th, with H showers, and S fell heavily at night, the ground being covered to a depth of 2 inches on 31st.

ABERYSTWITH, GOGERDDAN.—Strong gales from the N.W. on the 22nd and 29th, with H storms and T.

SCOTLAND.

CARGEN.—A very unsettled month, corresponding very closely to December, 1893. Severe gales were experienced on the 13th, 21st–22nd, and 28th–29th. The one on the night of the 21st and forenoon of the 22nd was the most disastrous since the gales of December, 1883, and January, 1884. Great damage was done throughout the district, the greatest occurring between 10 and 11 a.m. on the 22nd, the squalls amounting to almost hurricane violence. The mean temp. of the month, 40°·6, is 2°·2 above the average, and the fluctuations of temp. were very marked. The min. temp. on the 13th was 50°·6; the nearest to this high min. in December during 35 years was 49°·2 on 7th December, 1865, and 49°·1 on 3rd December, 1873. Rhododendrons were in flower towards the end of the month. The fluctuations of the bar. were very marked, the difference between 9 a.m. and 9 p.m. on 22nd being 1·168 in. N. and N.W. winds prevailed for 22 days. Sunshine 10 hours below the average.

JEDBURGH.—The weather was mild for the season; though there were a number of frosty days, frost never continued long, and out-door work was not stayed. With the exception of the 29th, there was no S, and then only a slight shower, which hardly covered the ground. High wind on 21st and 28th.

COLMONELL.—Rainfall slightly above the average. Very strong gale at night on 21st and morning of 22nd. Strong gales on 28th and 29th.

ABERDEEN, CRANFORD.—Terrific gale of wind, doing much damage, on 22nd.

ROEBERRY.—The first part of the month was fine, the latter part cold and stormy. On the morning of the 22nd, after a coarse night of wind and rain from the S., preceded by a few hours' calm, a heavy gale broke from the northward. Mean temp. 41°·8.

IRELAND.

DARRYNANE ABBEY.—A very mild month, with some heavy gales. H, mixed with S, on 29th. Gales on 18th, 22nd, and 29th.

WATERFORD, BROOK LODGE.—A few light showers of S on the last two days of the month. Mean temp. 43°·9.

O'BRIENSBRIDGE, ROSS.—An average rainfall for the season was attended by unusually high temp. until the 28th. The storm of 21st, so destructive elsewhere, passed over here with little injury; its greatest violence did not last more than one hour. With the storm of 28th also no serious loss occurred. S on 30th and 31st.

DUBLIN.—The earlier part of the month was characterised by anticyclonic conditions, and was quiet, chiefly fine, with a good deal of fog. From the 9th onward the distribution of atmospheric pressure was cyclonic, the depressions of 22nd and 29th being especially noticeable for the suddenness of their approach, and the havoc which they wrought. As in 1893, the month closed with a cold spell, with S, sleet, and H. Mean temp. 43°·9, 2°·6 above the average. Lunar halos appeared on 3, and solar halos on 2, days. High winds were noted on 12 days, and attained the force of a gale on 8. Foggy on 9 days. L on the 30th. Faint aurora on the 22nd.

CLIFDEN, KYLEMORE.—Very wet and stormy throughout. Severe gales from W. on 21st and 28th. S on 30th.

WARINGSTOWN.—A gale, unequalled since 1839, occurred on 22nd, doing great damage to buildings and trees.

EDENFEL.—With an average rainfall, the temp. of the month was remarkably mild, and there was little frost, and no snow even on the mountain tops till 29th. In other respects the last 10 days of the month left a mark that it will take many years to efface. No storm since that of January, 1839 has wrought such widespread havoc to buildings and to plantations as that of the night of Friday, 21st, and had its period of greatest violence lasted as long as in 1839, the damage to life and property would have been appalling. On the 29th another, but less violent, gale occurred after an extraordinary barometric *fluctuation*, between times, of from 28·70 in. to 30·90 in. (corrected).

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THE OBSERVATOR

A Monthly Review of Astronomy.

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(Savilian Professor of Astronomy.)

T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.

Contains full Reports of the Meetings of the Royal Astronomical
Meteorological Societies, and of the British Astronomical Association
by various eminent Astronomers, English, American, and Co
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SYMONS'S
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THE THUNDERSTORM ON JANUARY 23RD.

A SHORT, sharp thunderstorm, causing several accidents, occurred at various stations nearly along the meridian of Greenwich, in the forenoon of January 23rd. It was spoken of in *The Standard* as a "quick travelling secondary," and it was stated that "the nucleus of the thunderstorm was travelling S.S.E.wards at the rate of about 50 miles an hour." The rate *seems* to have been even higher than this, if there be no confusion as to the phenomena with which we are dealing, and we do not think that there can be, because, with the exception of the York record, the differences between the computed and observed times are rarely large.

STATIONS.	Distance measured along a line from Sunderland to Dungeness.	Beginning of Squall.	Computed Time at the Rate of 62 miles an hour.	
			Time.	Error.
	miles.	Time.	h. m.	h. m.
Sunderland	0	5.55a.m.	5.55 a.m.	0
Knaresborough	62	7.10 ,,	6.55 ,,	+ 15
York	67	5.45 ,,	7. 0 ,,	—1.15
Ketton	160	8.15 ,,	8.30 ,,	— 15
Kettering	180	8.30 ,,	8.49 ,,	— 19
Easton Mauduit	186	8.40?,,	8.55 ,,	— 15
Camden Square	239	9.46 ,,	9.46 ,,	0
Maida Vale	240	9.46 ,,	9.47 ,,	— 1
London	241	9.50 ,,	9.48 ,,	+ 2
Kennington	243	10. 2 ,,	9.50 ,,	+ 12
Kingston	246	10. 0?,,	9.53 ,,	+ 7
Croydon	251	9.55 ,,	9.58 ,,	— 3
Wallington	252	9.57 ,,	9.59 ,,	— 2
Crowborough	275	10.20 ,,	10.21 ,,	— 1
Ditchling	281	11. 0 ,,	10.27 ,,	+ 33
Hythe	282	10.20 ,,	10.28 ,,	— 8

We insert this table, not altogether on account of any inherent importance in it, but because we think that observers will see from it that if they are not careful in keeping their clocks and watches

right, it is tolerably certain that that fact will come out. It will be seen that in the following notes the Rev. H. A. Boys, of Easton Mauduit, says, "*about* 8.40"; it is clear, from the table, that 8.55 would harmonize better with the other records.

The point, however, of which we should like to see proof is the *motion* of the nucleus; there is no doubt that the phenomena occurred later, in the south, but that does not prove that *the* storm which was over Kettering about 8.30 a.m. was over London at 9.46 a.m.

These phenomena might be imagined to have something like a decennial period, and a fondness for January—at any rate, the following are the dates of some analogous cases :—

1869.	Jan. 16th.	Quar. Weather Report, 1869, pl. vii., and Quar. Journal Met. Soc., vol. iv., 1876, p. 75.
1876.	Jan. 30th.	Quar. Jour. Met. Soc., vol. iv., 1876, p. 73.
1886.	Jan. 13th.	Quar. Jour. Roy. Met. Soc., vol. xii., 1886, p. 292.
1895.	Jan. 23rd.	

In the discussion upon Mr. Scott's paper on the squall of 1886, Mr. Gaster explained why "care is necessary in deciding whether phenomena occurring in chronological order at a line of stations are the result of one travelling disturbance, or of several independent ones."

The following notes are arranged from N. to S. :—

SUNDERLAND.—The rise on the barogram is at 5.55 a.m.; there had been aurora at 4.35 a.m., but I have no record of the weather at 5.55 a.m., nor were T or L reported.—*T. W. Backhouse.*

CONYNGHAM HALL, KNARESBOROUGH.—There is a slight rise in the barometer curve at 7.10 a.m., but no T or L was observed here, although some of my men were up before 6 a.m. T was said to have been heard at Leeds.—*Basil T. Woodd.*

YORK.—Our barograph was gaining badly (corrected $3\frac{3}{4}$ hours on 25th), but I make the jump to have occurred at 5.45 a.m. Furious wind from N.W. or N.N.W., with sleety S. I did not notice the time. Cannot hear of any T or L.—*J. E. Clark.*

NEWARK.—Violent S and hailstorm in early morning with T and L.

SOUTH LINCOLNSHIRE.—A remarkable storm passed over here. A heavy leaden cloud enveloped the district about 8 a.m., and S fell thickly, accompanied by T and L. The wind blew a hurricane, and for about 15 minutes there was a perfect blizzard. The darkness was so intense that artificial light was necessary. After the cloud had passed, the sun shone out brilliantly, and continued during the remainder of the day; the weather, however, was bitterly cold.

KETTON, RUTLAND.—A very dark cloud passed over at 8.15 a.m.; the birds were frightened, and flew towards the house.—*F. Coventry.*

OUNDLE.—S, H, R, L and T in the morning.

KETTERING.—A violent storm burst over the town about 8.30 a.m. The lightning struck the dome of Rockingham-road Wesleyan Chapel, smashing a

portion of it, and slightly damaging the roof of the main building. At Messrs. Humphries and Barlow's shoe manufactory, the lightning severed a gas pipe and ignited the gas, which in turn set fire to the adjacent woodwork. The outbreak was discovered some time afterwards by the workpeople in an opposite factory, and was soon subdued. Throughout Northamptonshire it became so dark between 8.30 and 9 a.m., that lights were everywhere used.—*Standard.*

EASTON MAUDUIT, NORTHAMPTON.—Sun bright at 8.15 and 8.30 a.m.; about 8.40 I was startled by a long rattle of T, and saw a black cloud coming from N.N.W.; it burst on us, with snow and sleet, from about 8.50 to 9.30 (= ·05 in.), wind strong, and increased till noon, when it blew furiously.—*H. A. Boys.*

A WINTER THUNDERSTORM.

To the Editor of the Times.

SIR,—In other countries winter TSS are common; but in this country, when during a S shower there is vivid L and loud T, many persons look upon it as unprecedented. It is unusual, but that is all. If I am not mistaken, there has already been one English house wrecked by L this year; and this morning we had a short, sharp storm in London with H and S. The storm must have been extremely low in the atmosphere and very near this house, for the time-interval (that is, the interval between seeing the L and hearing the T) was extremely short. The times of the L, of the T, the time-interval, and the duration of each peal of T were as follows:—

Lightning.			Thunder.			Time-Interval.	Duration of Thunder.
H.	M.	S.	H.	M.	S.		
	—		9	46	45	—	—
9	52	10	9	52	12	2 secs.	8 secs.
9	53	8	9	53	11	3 secs.	7 secs.
9	53	37	9	53	40	3 secs.	5 secs.
9	53	56	9	54	0	4 secs.	3 secs.
9	54	56	9	55	1	5 secs.	29 secs.
9	56	30	9	56	33	3 secs.	14 secs.

Adopting the usual approximate rule that sound travels a mile in five seconds, we see that all these flashes occurred within a mile of this house, and most of them within half a mile. There was, as usual, a sharp rise of the barometer, ·049 in. in about ten minutes, a fall of 5 deg. in temperature, while the H and S when melted yielded just 0·10 in. water. It was very soon over, and by 10.10 a.m. the sun was shining brightly.—Your obedient servant,

62, Camden Square, N.W., Jan. 23rd. G. J. SYMONS.

MAIDA VALE, LONDON.—First T at 9.46 a.m.; L and T at 9.51 to 9.58; squall commenced 9.53, moderated at 10.7 a.m.—*K. J. Marks.*

WILLESDEN.—The TS was accompanied by a heavy downfall of H and S. One flash of L had the appearance of a huge bomb bursting in the air.

LONDON.—Early yesterday morning a remarkable storm swept over London. It began to rain at about 9.50, with a boisterous wind from the south-west, which suddenly raced to the north, changed the R to sleet, then to H, and finally settled down to a good fall of S. Darkness as of night now prevailed as a sharp thunderstorm passed. Five minutes afterwards the sky presented a clear blue, with a comparatively balmy air and brilliant sunshine, the wind gently blowing from the north-west.—*Daily Graphic.*

LONDON.—Almost simultaneously with one of the severe claps of T, the steeple of St. Clement Danes Church in the Strand was so shaken that the bells were set ringing, and were heard distinctly in one of the rooms in the basement of the Law Courts opposite. The Churchwarden expresses doubt of this, but evidence on the other side is distinct. There is also the confirmatory evidence that another report states that "during the TS, people in the Strand heard a muffled and then a loud peal of bells from the belfry of the church of St. Clement Danes. It was subsequently found that the steeple had been struck by L, and that, with the heavy T, had started the bells. No damage was, however, done."

WESTMINSTER.—The church of St. Stephen, Rochester Row, was struck by L. The conductor on the spire was first struck, but the conductor crossed a gaspipe, and there the L melted the lead and ignited the gas. This set fire to the organ loft, but the attention of a bellringer was attracted, and he succeeded in extinguishing the flames.

CHISWICK.—A horse attached to a carrier's cart was struck dead by L in the Chiswick High Road on Wednesday morning. The animal was standing outside a public-house, where its master was taking shelter from the storm, when the L, which was very vivid, and followed by a heavy clap of T, struck it behind the left ear.

KENNINGTON.—The storm was very severe. Just after ten o'clock, S and H fell heavily, accompanied by a perfect hurricane, and the L and T which followed were terrific. For a time it was almost impossible to carry on the tram or omnibus traffic, and passengers on the roofs of the omnibuses and trams sought shelter in the shops and other covered ways. There was great delay in the changing of horses at the Kennington terminus, and the road was so slippery that the animals in many instances could not keep their feet. The tram company will be heavy sufferers by the injuries done to their stock.

BRIXTON.—In this neighbourhood much damage was done to glass, and many trees were blown down by the gale.

BLACKHEATH, LONDON, S.E.—Many watches stop in London daily, but the following *may* be of interest.—ED.

THUNDERSTORMS AND WATCHES.

To the Editor of the Standard.

SIR,—During the remarkable thunderstorm which passed over London yesterday morning my watch suddenly stopped. At the time I did not think much of the occurrence, although my watch has never done so before; but I afterwards met no fewer than four persons who told me that the same thing had happened to them. I think this must be something more than a mere coinci-

dence, and it would be interesting to know whether any other of your readers have met with a similar experience.—I am, Sir, your obedient servant,

4, The Grove, Blackheath, S.E., Jan. 25. G. H. ELDER.

SHEERNESS.—An interval of darkness, followed by S, with T and L, and a N.W. gale.

SHEPPEY, LEYSDOWN.—Squall with H, T, L, and a N. gale, then sunshine.—*A. Farbrother.*

HERNE BAY.—The storm broke here with considerable fury about 10 a.m., and was accompanied by sleet and S, and the tide was unusually high.

KINGSTON-ON-THAMES.—About 10 a.m. the sky suddenly became overcast, and a torrent of large hailstones, accompanied by T and L, swept over Kingston-on-Thames. So violent was the wind that 6 large trees in Lower Ham Road were levelled with the ground in an instant. Several windows in the houses in Lower King's-road were blown in, a chimney and part of the roof of one house were blown away, and a large tree in the grounds of the residence of the Mayor, Alderman Sherrif, was blown against the house and did much damage. At the infants' school in Richmond-road slates were dislodged, and in London-street tiles were blown off several houses. At the railway station, several large boards were hurled down, and the bookstall was cleared of its papers, which were scattered about. The L rang the fire alarms in Kingston, and the Brigade quickly turned out, only to find that their services were not required.

LOWER ADDISCOMBE ROAD, CROYDON.—Two claps of T at 9.55 a.m., squall at 10 a.m., R, then dark, then sleet, changing to H, then lighter, with S till 10.20 a.m.—*H. Newby.*

WALLINGTON.—According to the trace of my barograph, the TS passed here at 9.57 a.m.—*F. C. Bayard.*

HYTHE, KENT.—At 9 a.m. R, at 10.20 a.m. dense darkness and S blizzard, which lasted for a few minutes.—*H. Mackeson.*

CROWBOROUGH OBSERVATORY, SUSSEX.—Sky became suddenly overcast about 10.15 a.m. by a dense mass of cloud from N.W.; S soon began, and in less than five minutes quite a hurricane came on, and a regular blizzard, which continued till about 10.35, when it ceased as suddenly as it had begun. At 10.25 a.m. there was a brilliant flash of L, and a very loud and *prolonged* peal of T; the spire of Rotherfield Church was struck, but the conductor proved equal to the occasion, and scarcely any damage was done.—*C. L. Prince.*

DITCHLING, SUSSEX.—Heavy S squall at 11 a.m.—*F. H. Phillips.*

We are glad to be able to state that this subject will be treated of in a paper by Mr. W. Marriott at the meeting of the Royal Meteorological Society on February 20th.

CLASSIFICATION AND DEFINITION OF CLOUDS.

To the Editor of the Meteorological Magazine.

SIR,—In the January number of your Magazine, Mr. Scott's report to the Royal Meteorological Society on the "Classification and Definition of Clouds," adopted by the International Meteorological Committee last August, differs somewhat from my own report on this subject, published in the *American Meteorological Journal* for December, 1894, and reprinted in *Nature* of December 20th.

As a member of the Special Committee appointed at Munich in 1891 to report on a new Cloud Atlas to the Permanent Committee, of which Mr. Scott has so long been the indefatigable and efficient secretary. I should like to explain my interpretation of the official *procès-verbaux*, which Mr. Scott has evidently translated. The cloud classification recommended is substantially that of Abercromby and Hildebrandsson, for which the Atlas, with its text in four languages, published in 1890 by Drs. Hildebrandsson, Köppen, and Neumayer, has been generally accepted hitherto by Meteorological institutions as an authoritative exposition. This Atlas formed the basis of the Cloud Committee's discussion at Upsala, and I have, therefore, preferred to follow closely its English text, except so far as modifications introduced by us in its French text (which alone was considered) affected the former.

The differences between Mr. Scott's version and my own are, in general, immaterial, but I should like to substitute for his definition of Alto-Cumulus (dense fleecy cloud), "largish globular masses"—my definition of "larger . . . . balls"—as being a better rendering of the French text, and also as showing this cloud's relation to Cirro-cumulus (fleecy cloud), which is defined as "small white balls," or, according to Scott, "small globular masses. . . . "

Regarding cloud heights, I would call attention to the note in my report pertaining to the altitude of the Nimbus and Cumulo-nimbus, as measured at Blue Hill. It was here found that the bases of the Nimbus frequently fell below 1,000 metres (3,280 feet) while the tops of the Cumulo-nimbus often attained 8,000 metres (26,240 feet). Prof. Hildebrandsson, the Chairman of the Publication Committee for the Cloud Atlas, has promised to modify the altitudes stated in this Atlas, so that low clouds shall include those below 2,000 metres, and the superior limit of the Cumulo-nimbus shall be raised to 8,000 metres. With these changes, the heights of the clouds measured in Sweden are in fair agreement with the same clouds measured by identical methods in America.

The importance of an exact statement of definitions in the first announcement of what will doubtless soon come into current use in meteorology is my excuse for occupying your space with such details. Our Committee has sought to secure accuracy by requiring

that translations of the French, English, or German text into other languages shall be made under the supervision of the Publication Committee, consisting of Prof. Hildebrandsson, M. Teisserenc de Bort, and Prof. Riggenbach.—Yours faithfully,

A. LAWRENCE ROTCH, F.R.Met.Soc.

Blue Hill Observatory, Readville, Mass., Jan. 30th, 1895.

[The responsibility for the account of the Meeting of the *Roy. Met. Soc.* rests entirely with us, we believe the report of Mr. Scott's paper to be substantially correct.—ED. *Met. Mag.*]

REVIEWS.

Cloudland. A Study on the Structure and Characters of Clouds, by Rev. W. CLEMENT LEY, M.A., F.R.Met.Soc. London: Stanford, 1894. large 8vo. ix.–208 pages, 6 coloured plates, 8 photo prints, 4 charts, and 10 diagrams.

IT is with a feeling of sadness that we begin our notice of this work, for the preface is signed, not by the author, W. Clement Ley, but C. H. Ley. Mr. Clement Ley has devoted years to the study of clouds; probably since man first trod this earth, no one, not even Luke Howard, watched the clouds more carefully, or for a longer period. For years he has been collecting facts for, and looking forward to the publication of, this work, but he was too enthusiastic, and as the result he has been unable to complete it. We are sure that he and his family will have the sympathy of all our readers.

We, however, have to report upon the book, not on the author; and we can begin by saying that the get-up of the book is faultless, and that the reproductions of Mr. Clayden's cloud photographs are the best we have ever seen. Years ago (in 1872) we had to review Mr. Clement Ley's *Laws of the Winds in Western Europe* (Part I.). Part II never appeared; but it seems to us that the latter portion of the present work, with its isobaric charts, &c., would be nearly equally appropriate as a sequel to *Laws of the Winds* as it is to *Cloudland*.

However, it is with *Cloudland* that we have to do; and we cannot say that we like it. The nomenclature is founded upon Howard's (whose name, strange to say, we have not seen anywhere in the volume), but split up into no fewer than 26 varieties, and some of them with nearly that number of letters in their name, *e.g.*, Cumulonimbus Grandineus. If clouds, like plants, had definite forms, it would be easy to adopt 26 or 260 names just as botanists do, but, unfortunately no two clouds are alike, and every cloud is constantly changing in appearance, both from its own change of structure, and

from the varying angle which its motion causes it to make with the eye of the observer. We, therefore, think that to attempt to provide a nomenclature to suit all times and climes is to attempt the impossible.

We think, however, that the publication of this book is singularly opportune, because, if we understand aright the proceedings of the International Meteorological Committee, that body is going to issue "an authoritative cloud atlas"—the appearance of which we await with interest—and it is evidently advantageous that the members of that Committee have had the opportunity of considering the outcome of Mr. Clement Ley's researches before issuing their report.

It is, perhaps, desirable that we should mention that Mr. Ley has two classes of clouds, one of less importance than the other; and that each class is divided into four varieties:—clouds of (1) radiation, (2) interfret, (3) inversion, (4) inclination. For the precise meaning which he attaches to the above words we must refer the reader to the work itself.

Mr. Ley tells one bright little story which well illustrates the remarkable personal utility of his life-long study.

"47. Occasionally when the area of high barometric pressure at the [earth's] surface is gaining the victory, and the advancing cyclonic disturbances are dying out, this form of cloud disappears, or is superseded by Stratus Quietus, or by other cloud varieties of less interesting type. But rather more frequently the ulterior development into Cumulo-nimbus occurs here and there as the cyclonic disturbances approach. The possibility of hazarding a prognostic of this development, even when the direction of the movement of the cloud is totally unknown, may permissibly be illustrated by the following little anecdote, which at the same time indicates the small amount of attention devoted to the form of cloud. An artist, possessed of a keen sympathy with nature, and a most conscientious draughtsman, showed the writer a painting of a sky marked by this cloud in unusually large proportions, occurring over North Britain, and asked what kind of weather was experienced subsequent to the drawing of his sketch. He received the correct answer that a severe thunderstorm occurred within about an hour of the time when the sketch was taken, although in the painting there were no representations of those clouds which are commonly called "thunderclouds." On being asked what certain other painters had remarked about his painting, the artist answered, "they only say 'What a funny cloud.'"

In artistic matters our judgment is probably worth little, but we have not yet seen any coloured plates of clouds which, in our opinion, approach success. As reproductions of the originals, and as specimens of colour printing, we do not doubt the excellence of plates i. to vi. in *Cloudland*, but we infinitely prefer the photo-prints in the same book: they are very similar to those by Sig. Manucci, published by the Specola Vaticana; we could not give them higher praise, for they are as like nature as any reproduction that we can imagine. The problem before the compilers of the "authoritative cloud atlas" is, we think, neither the obtaining of good photographs, nor their reproduction, but giving names and definitions which shall be better than Howard's, and last in favour as long as his, viz., 91 years.

Annales de l'Observatoire Météorologique du Mont Blanc (altitude 4,365 metres = 14,321 feet), publiées sous la Direction de J. VALLOT, Fondateur et Directeur de l'Observatoire. Paris, Steinheil, 1893, 4to, xvi.-190 pages.

THE first article in the *Meteorological Magazine* for 1889 bore the strange but true title of "Three days on the top of Mont Blanc." That article explained how a French gentleman, entirely at his own cost, had requested Messrs. Richard Fréres to construct a remarkable series of meteorological instruments, had a tent, food, fuel, and all the instruments and material required for their installation, carried to the top of Mont Blanc, and how he and M. F. M. Richard jointly erected them, and took the observations.

It was M. J. Vallot who did all that, it is to M. J. Vallot that we are indebted for the sumptuously printed volume which to our regret has had to wait long for the very hearty welcome we are glad to give it.

It is curious that High Level observatories are generally the result of private enterprise. Scotland would never have had Ben Nevis but for Mr. Wragge, France would not have had the Pic du Midi but for General de Nansouty, and there would have been no observatory on Mont Blanc but for M. J. Vallot.

If subsequent volumes resemble the first there will be a large collection of very useful and interesting information; there is so much in the present volume that it is difficult to do justice to it.

The preface deals with the issue of the Annals, the arrangements of the observatory, which is now a large and comfortable building with eight rooms, besides an annexe with two rooms for tourists and guides. The arrangements for the accommodation of scientific men who desire to carry on experiments at a high altitude are extremely liberal—hospitable would, perhaps, be a better word. We ought, perhaps, to explain that the observatory is not on the absolute summit, but in what is in many respects a better position, viz., on the Roches des Bosses, at 14,321 ft., the highest summit being 15,781 ft.

M. J. Vallot, who is evidently a lover of the mountain, probably knows it even better than the guides, and must have spent several thousand pounds in what has already been done, seems to us to have three primary objects: (1) Meteorological research; (2) Aiding all branches of scientific work on Mont Blanc; (3) Producing a rigorously accurate map of it on the scale of 8 inches to the mile by an entirely new triangulation and survey.

The eleven articles in the present volume are extremely interesting, and are mostly by either M. H. or by M. J. Vallot. The first epitomizes the results (and reproduces the curves) of synchronous records of barometers at Chamonix (3,396 ft.), Grands Mulets (9,876 ft.) and Summit (15,781 ft.). Perhaps the most noticeable feature is the excessive thickening of the barometer trace during storms, it might be thought that this was due to the wind shaking the instrument, but in a later article M. J. Vallot shows conclusively

by the records of a statoscope that they are really due to differences of pressure, and by taking the statoscope into the open and sitting on a rock, while holding it and allowing it to make its record, he showed that the cause is a natural one, quite independent of any change produced in a confined space by the passage of a strong air current. He, therefore, holds that the oscillations are due to the passage of a multitude of small disturbances (may we not say to eddies in the general atmospheric stream, which are as imperceptible at low altitudes in the atmosphere as would water eddies be to an observer at the bottom of a river). The use by M. Vallot of the word 'tourbillons' suggested to us that of whirls, but we see no evidence of circular motion; we presume that when a current of air which we should call (say) a strong W. wind flows over the plains of France some parts of the current are going faster than others, when the current reaches Mont Blanc it must escape laterally or rise and flow over the top, and it is to the passage of streams at various velocities and various angles that we should attribute the irregularities in the atmospheric pressure recorded by the barometer and confirmed by the statoscope.

Another interesting article is on the acccuracy of the temperature correction of Fortin, Aneroid and Bourdon barometers; and then there is the full story of how M. Eiffel drove a tunnel into Mont Blanc 46 ft. below the summit, which tunnel, originally 97 ft. long, and subsequently lengthened by 75 ft., went all the way through solid ice; but there is no end to the information, there are exciting stories of a death from Mal de Montagne, and of two by an avalanche, we hear how one man secured sleep only by opium and phénacétine, and another was brought round by some of the oxygen which M. Vallot had always in reserve; but we must stop. It is one of the most fascinating books which we have read, copiously illustrated, and one of which any government and *à fortiori* any private gentleman may well be proud.

THE SCIENTIFIC USE OF KITES.

WE believe that the first use of a kite in connection with meteorology was about 1750, when Franklin, in his well-known experiment, obtained electrical discharges from a thunder-cloud by means of a cord carried up to the cloud by a kite. Admiral Back, when in command of the "Terror" in 1836 and 1837, is reported to have used a kite to obtain the temperature of the upper air in the Arctic regions; and Sir Francis Ronalds, at Kew, in 1847, made experiments with kites.

In 1882 Mr. Douglas Archibald carried on a somewhat elaborate series of scientifically conducted experiments with anemometers and thermometers carried by kites up to heights of about 2,000 ft. With the object of obtaining additional power he used a series of

kites flown "*tandem*," *i.e.*, one above the other, and was, we believe, the first to adopt this device. Thus from time to time this comparatively simple and inexpensive apparatus has been tried for meteorological work, but we believe it has never been used by any of the Government services, although the results obtained would, we think, amply justify a more extensive and prolonged series of trials.

After the lapse of another ten years, for we believe Mr. Archibald's observations were the last, we find a fresh series of experiments, this time in America, and the authors in an article in the December number of the *American Meteorological Journal*, speak hopefully of the value of the results to be obtained.

The experiments were made at the Blue Hill Observatory of the well-known meteorological enthusiast, Mr. A. Lawrence Rotch, by Mr. William A. Eddy, of Bayonne, N.J., who, by means of the *tandem* principle, has sent up kites to altitudes exceeding a mile.

A modified Richard thermograph was constructed chiefly of aluminium on a hard rubber base, the total weight being only one pound eight ounces.

On August 4th this thermograph was carried up by six kites, reaching an altitude above the hill-top of 1,000 ft., and again on August 15th, the results obtained being compared with the records of Richard thermographs at the Observatory, 640 ft. above sea-level, and at the Valley Station two miles N. of the observatory and 50 ft. above sea-level.

Rate of Decrease of Temperature per 100 *ft., August 4th*, 1894.

Time.	2.22 p.m.	2.41 p.m.	3.8 p.m.	3.10 p.m.	4.37 p.m.	5.3 p.m.	5.5 p.m
Valley to Summit	0°·41	0°·37	0°·34	0°·39	0°·39	0°·49	0°·39
Summit to Kite ...	1°·43	1°·01	0°·90	0°·66	0°·33	0°·36	0°·50

August 15th, 1894.

Time.	1.30 p.m.	1.52 p.m.	3.28 p.m.	3.30 p.m.	4.3 p.m.	4.18 p.m.	4.20 p.m.
Valley to Summit	0°·80	0°·76	0°·46	0°·47	0°·47	0°·41	0°·41
Summit to Kite ...	0°·14	0°·28	0°·36	0°·40	0°·51	0°·18	0°·26

On August 4th the sky had been clouded during the morning with strato-cumulus surmounted by a sheet of alto-stratus, but these began to break away about 2 p.m., and after 3.10 p.m. the sun came out though the sky continued more than half covered. While the kites were in the air the wind was from W. and N.W., with a velocity gradually rising from ten miles at the beginning to twenty miles at the end of the experiment. The barometer was rising, a minimum having occurred during the preceding night.

On August 15th during the experiment the wind blew steadily from the south with a nearly constant velocity of about twenty miles an hour. The barometer was falling slowly. The sky was covered with alto-cumulus and alto-stratus increasing in density, and it became necessary to draw down the kites on account of the approach of a thunder-shower.

The following are among the results furnished by the kites :—

"On July 31st the kites were let up at noon in a sea breeze. When the kites had risen about 400 ft. above the hill the topmost kite veered round from the west, thus giving the depth of the sea breeze as 1,000 ft. above sea level. During the afternoon the sea breeze steadily increased in depth and veered toward the south."

"On August 6th, during the prevalence of light winds from the west, an effort was being made to elevate the kites which refused to remain permanently in the air since the air movement was not sufficient to sustain the heavy kites employed. But at 2.20 p.m., while a five-foot kite was being maintained at a short distance above the hill by means of sundry jerks and pulls, a rather large cumulus cloud approached the zenith, and suddenly the kite began to ascend almost vertically. Cord was rapidly let out and in a short time the kite was flying directly overhead, and continued to rise until all the available cord had been let out. It followed the cumulus for a short distance beyond the zenith, then rapidly dropped to the earth. Mr. Eddy afterward measured the length of cord out and reported 1,172 ft., which must have been approximately the altitude of the kite since the cord hung almost vertically under it. This seems to furnish striking evidence of the existence of ascending currents under the cumulus clouds."

"The kites also at times gave evidence of great ærial eddies around and above the hill, which swayed the kites from side to side."

"It is hoped to continue these experiments at the Blue Hill Observatory, and if possible reach great altitudes. Mr. S. P. Fergusson believes he can construct a meteorograph which will record pressure, temperature, wind velocity, and humidity, and not be beyond the lifting-power of the kites."

ROYAL METEOROLOGICAL SOCIETY.

THE annual meeting of this Society was held on January 16th, at the Institution of Civil Engineers, Mr. R. Inwards, F.R.A.S., President, in the chair.

The report of the Council was read by Mr. F. C. Bayard, and showed a successful year, and general activity in the various branches of work undertaken by the Society and its Committees. Forty-five Fellows were elected during the year, and the number on the roll increased, although the Society lost by death two Honorary Members and 11 Fellows. The balance-sheet shows an excess of assets over liabilities of nearly £3,000, in addition to the library and instruments, and £1,300 of funds held for special purposes. The following are the officers and council for the ensuing year :—

President, Mr. R. Inwards ; *Vice-Presidents*, Dr. Robert Barnes, Mr. Peregrine Birch, Dr. C. Theodore Williams, Captain Wilson-Barker ; *Treasurer*, Mr. H. Perigal ; *Secretaries*, Mr. F. C. Bayard, Mr. G. J. Symons ; *Foreign Secretary*, Mr. R. H. Scott ; *Council*, Messrs. A.

Brewin, G. Chatterton, R. H. Curtis, W. H. Dines, W. Ellis, C. Harding, Baldwin Latham, Admiral J. P. Maclear, Mr. E. Mawley, Dr. H. R. Mill, Messrs. H. Southall and Sowerby Wallis.

The President delivered an address entitled "Weather Fallacies," being practically a brief history of prophetic weather lore from the times of Hesiod, Theophrastus and Aratus to the present day, grouped under Saints Day fallacies, sun and moon fallacies, and those concerning animals and plants, Almanac makers, weather prophets and impostors. Owing to the vastness of the subject the paper was necessarily condensed, and no abstract can be given.

The usual votes of thanks were accorded to the Officers, Council, Committees, &c., and to the Institution of Civil Engineers for the use of their theatre for the meetings of the Society.

The annual meeting was preceded by an ordinary meeting, at which several new fellows were elected, and a paper was read by Mr. Charles Harding on the gale of December 21st-22nd. He said that this storm was one of exceptional severity, especially over the northern portions of England and Ireland, and in the south of Scotland. It developed energy very quickly and travelled with great rapidity, the centre of the disturbance traversing the north of Scotland. The self-registering anemometers show that the greatest violence of the wind occurred at Fleetwood, where the velocity of the wind was 107 miles in the hour, recorded at nine o'clock on the morning of the 22nd, and for four consecutive hours the velocity of the wind exceeded 100 miles. This is the greatest force of wind ever registered in the British Isles, and the maximum velocity is eleven miles an hour in excess of the highest recorded in the "great storm" of November 16th-20th, 1893. At Holyhead the wind in squalls attained the hourly velocity of 150 miles between 10 a.m. and noon on the 22nd, and at Liverpool the wind travelled 89 miles between 10.30 and 11.30 a.m. The strongest force of the wind was generally from the north-westward. Exceptionally violent gusts of wind were experienced during the gale in nearly all parts of the United Kingdom, and at Greenwich a pressure of 28 lbs. on the square foot was registered at about 6 a.m. on the 22nd. A precisely similar squall was registered a few minutes earlier at Kew, while two hours earlier a squall passed over Falmouth, in which the changes of wind, barometer, and temperature justify the opinion that it was due to this same disturbance, travelling at the rate of about 120 miles an hour. The storm was of comparatively short duration, but at Fleetwood the velocity of the wind was 85 miles an hour, or above, for eleven hours, and the average wind velocity for twenty-three hours was 77 miles. Much destruction was wrought both on sea and land, and there was a very heavy loss of life. The Board of Trade returns received up to January 16th show that 167 lives were lost at sea on our coasts within the limit of the wreck chart, and there was also great loss of life in the North Sea. One hundred and ten casualties were posted on the Loss Book at

yd's, mostly due to the gale. The Lifeboats of the Royal ional Lifeboat Institution were launched forty-three times during gale, and they were the means of saving 103 lives and two sels. The storm appears to have traversed the Atlantic, and was ıated to the south of Bermuda on December 19th.

n the discussion which followed, Mr. Symons quoted from a er addressed to Mr. H. S. Eaton, giving observations of the lection of the Blackpool Tower (500 feet in height) obtained by ssrs. Ashley and Bell, who remained in the room at the top ing the gale. The maximum deflection was about 2¼ inches. . Symons also summarised observations of the deposit of salt on ıdow panes and foliage during the gale, showing that it was orded at Settle, 24 miles from the sea, Sowerby Bridge, 40 miles, lton Abbey (42 miles), Meltham (45 miles), Harrogate (50 miles), st Ardsley, Wakefield (57 miles), Bramhope (60 miles), Masham miles), and Birmingham, 55 miles from the Bristol Channel, and ırly 100 miles from Cardigan Bay.

Admiral Maclear remarked that the velocities given by Mr. Harding eed by 50 per cent. hurricane force of Beaufort Scale, and yet effects of the wind bear no comparison to what he had himself n in hurricanes in the China Sea.

Mr. Curtis spoke on the bearing of the factor used in graduating emometers on the results given by Mr. Harding, and explained t the bridled anemometer at Holyhead was graduated by direct periments made by Mr. Dines on his whirling machine at rsham.

Mr. Harding, in his reply, said that as there was no case in which anemometer had survived a tropical hurricane, there was no ormation as to what the velocity in them really was.

THE WEATHER OF JANUARY: A RECORD?

To the Editor of the Meteorological Magazine.

SIR,—There have, of course, been colder Januarys than the last, but one, so far as my observations go, in which there has been such a iform dead-level of low temperature from beginning to end. ere was not a single day in the whole month which could be led "mild" even for the time of the year. The absolute maximum the shade, 41°·8, is not only the lowest that I have registered in y January, but in any month of any year covered by my observa- ns. The nearest approach to such a low maximum, in the 23 years ring which I have carried on regular observations in the Midland strict, was in January 1879, when the maximum was 44°. e next nearest was in January 1881, when it was 46°·4. s only one other instance during the 23 years when the ma s below 50°, viz., in 1891, when it was 49°·2. The mean

absolute maxima for the whole period being 52°·3; more than 10 degrees above the highest point reached by the thermometer in January 1895. I shall be interested to hear whether so low a maximum has been registered by any observer in the Midland district either in last January or in any month of any previous year.

GEORGE T. RYVES, F.R.Met.Soc.

Tean Vicarage, Stoke-on-Trent,
February 4th, 1895.

THE FROST OF FEBRUARY, 1895.

As the frost still (13th) continues, it would be impossible to deal with it satisfactorily in this number; we therefore hold over until next month all communications received. Exceptionally low temperatures have been recorded in many parts of the kingdom, especially about Leicester, where, owing to its central position, the climate approximates more nearly to Continental conditions.

At Camden Square, the frost—considering both intensity and duration—is clearly unprecedented since observations commenced in 1858; from a cursory examination of the Greenwich values, it appears to be similar to that of 1855.

UNUSUAL SNOW CRYSTALS.

To the Editor of the Meteorological Magazine.

SIR,—During the recent cold and snowy weather, I have been constantly on the look-out for remarkable snow crystals, but without success until this morning, when at 8.30 a.m., with the temp. about 10°, snow was falling in single crystals, varying considerably in size, and many of them exceptionally large. With the same pocket scale referred to in my letter of January 6th, 1894, I measured about a dozen, and succeeded in finding two even larger than the largest recorded in that letter. One measured exactly $\frac{1}{12}$ inch, and the other a shade under $\frac{2}{24}$ inch. I have not seen any spherical crystals, but found several with an additional limb starting from the centre at the usual angle of crystallisation.

Yours very truly,

H. SOWERBY WALLIS.

25, *Northwood Road, Highgate, February 7th*, 1895.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	88·2	6	48·9	14	73·0	54·8	53·7	74	128·2	42·6	3·25	17	6·9
Malta	96·3	12	64·7	3	87·6	69·0	67·1	69	150·0	58·3	·00	0	1·9
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	77·6	11	59·7	21	74·9	64·8	61·6	77	124·7	48·6	2·29	19	5·0
Calcutta	90·8	14	75·7	11	86·9	78·0	78·2	88	159·7	74·6	11·34	18	8·3
Bombay	87·5	2	74·1	17	84·2	77·0	76·3	86	134·5	72·0	26·16	31	8·6
Ceylon, Colombo	86·7	1	73·3	...	84·4	77·0	71·6	78	145·5	70·0	1·72	13	5·6
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	68·1	27	37·2	8	58·0	45·5	44·0	78	123·8	30·7	3·50	17	7·1
Sydney	68·9	28	40·4	11	58·7	45·4	40·0	74	111·9	27·9	1·35	7	3·1
Wellington	59·0	26	34·5	28	53·4	44·4	41·4	76	98·0	24·0	6·49	21	5·5
Auckland	62·0	3	39·5	28	58·6	46·6	45·0	75	116·0	37·0	4·35	19	5·6
Jamaica, Kingston	92·9	17	66·3	25	89·2	72·1	71·0	73	...	...	1·21	6	3·6
Grenada	87·0	29	72·0	1, 6	83·8	74·5	68·9	72	157·0	...	3·53	22	4·3
Trinidad	92·0	6	66·0	25	88·5	69·4	70·2	77	172·0	62·0	4·53	15	...
Toronto	89·9	12	46·6	9	79·5	58·7	57·8	69	...	41·5	1·61	13	4·5
New Brunswick, Fredericton	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	95·8	16	40·0	4	81·3	54·9	...	...	...	...	·63	12	4·6
British Columbia, Esquimalt	84·0	12	45·2	31	69·1	49·6	51·7	81	...	...	·21	6	2·3

REMARKS.

MALTA.—Adopted mean temp. 77°·6. Mean hourly velocity of wind 6·2 miles. Sea temp. rose to 81°·3. The dew point temp. ranged between 49°·7 on 12th and 73° 8 on 30th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·7 above, of dew point 2°·2 above, and rainfall ·09 in. below, their respective averages. Mean hourly velocity of wind 11·1 miles below average; extremes, 26·1 on 2nd, and 1·7 on 21st and 22nd; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

Adelaide.—Mean temp. 0°·2 above, and rainfall ·88 in. above, the average of 37 years. A very cloudy month, the mean amount being 1·5 above the average of 25 years. Good rains fell over the agricultural districts, mostly in excess of the average, especially in the South-Eastern district; but in the Northern, North-East and North-West is was for the most part light and deficient. C. TODD, F.R.S.

Sydney.—Temp. 0°·4 below, humidity 3°·1 below, and rainfall 3·11 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Showery, unpleasant weather during this month, with occasional intervals of fine days; prevailing S.E. and N.W. winds, generally moderate in force. On the 20th, severe TS, with heavy rain and hail; also hail on 26th. Mean temp. 1°·3 above, and rainfall ·16 in. above the average. Aurora on 20th and 21st. R. B. GORE.

Auckland.—Showery and unsettled, but not more so than is usual in July. Mean temp. slightly above, rainfall just under, the average. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 4·3 miles. In Kingston the rainfall was about one-half the average, but the mean for every division was a little over the average. R. JOHNSTONE.

TRINIDAD.—Rainfall 4·92 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·45	XI.	Lake Vyrnwy	4·85
,,	Birchington, Thor	3·17	,,	Corwen, Rhug	3·35
,,	Hailsham	2·85	,,	Carnarvon, Cocksidia ...	2·81
,,	Ryde, Thornbrough	4·00	,,	I. of Man, Douglas	2·61
,,	Emsworth, Redlands ...	2·69	XII.	Stoneykirk, Ardwell Ho.	2·66
,,	Alton, Ashdell.....	2·79	,,	New Galloway, Glenlee	2·18
III.	Oxford, Magdalen Col...	2·48	,,	Melrose, Abbey Gate...	3 47
,,	Banbury, Bloxham	2·90	XIII.	N. Esk Res. [Penicuick]	3·75
,,	Northampton, Sedgebrook	2·74	,,	Edinburgh, Blacket Pl..	1·77
,,	Alconbury	2·49	XIV.	Glasgow, Queen's Park.	·58‡
,,	Wisbech, Bank House..	2·67	XV.	Inverary, Newtown	2·18
IV.	Southend	1·66	,,	Islay, Gruinart School..	1·30
,,	Harlow, Sheering	2·09	XVI.	Dollar.....	2·07
,,	Colchester, Lexden.....	1·98	,,	Balquhidder, Stronvar..	3·31
,,	Rendlesham Hall	4·24	,,	Ballinluig	3·75
,,	Diss	3·07	,,	Dalnaspidal H.R.S. ...	3·94
,,	Swaffham	3·21	XVII.	Keith H.R.S.	1·95
V.	Salisbury, Alderbury...	3·51	,,	Forres H.R.S.	3·14
,,	Bishop's Cannings	3·53	XVIII.	Fearn, Lower Pitkerrie.	2·74
,,	Blandford, Whatcombe.	3·77	,,	Loch Shiel, Glenaladale	4·51
,,	Ashburton, Holne Vic....	5·31	,,	N. Uist. Loch Maddy ...	2·92
,,	Okehampton, Oaklands.	4·69	,,	Invergarry	1·75
,,	Hartland Abbey	3·77	,,	Aviemore H.R.S.	3·83
,,	Lynmouth, Glenthorne.	3·80	,,	Loch Ness, Drumnadrochit	2·46
,,	Probus, Lamellyn	6·13	XIX.	Invershin	2·19
,,	Wellington, Sunnyside..	3·94	,,	Scourie	2·86
,,	Wincanton, Stowell Rec.	4·11	,,	Watten H.R.S.	2·75
VI.	Clifton, Pembroke Road	3·93	XX.	Dunmanway, Coolkelure	5·61
,,	Ross, The Graig	4·40	,,	Fermoy, Gas Works ...	2·91
,,	Wem, Clive Vicarage ...	3·53	,,	Killarney, Woodlawn ...	5·11
,,	Cheadle, The Heath Ho.	4·82	,,	Caher, Duneske	4·23
,,	Worcester, Diglis Lock	3·32	,,	Ballingarry, Hazelfort...	2·30
,,	Coventry, Coundon	4·12	,,	Limerick, Kilcornan ...	...
VII.	Ketton Hall [Stamford]	2·70	,,	Ennis	2·29
,,	Grantham, Stainby	3·62	,,	Miltown Malbay.....	2·55
,,	Horncastle, Bucknall ...	3·18	XXI.	Gorey, Courtown House	5·04
,,	Worksop, Hodsock Priory	3·54	,,	Athlone, Twyford	1·92
VIII.	Neston, Hinderton	3·45	,,	Mullingar, Belvedere...	1·87
,,	Preston, Haighton	1·94	,,	Longford, Currygrane...	2·07
,,	Broughton-in-Furness..	3·45	XXII.	Woodlawn.....	3·31
IX.	Ripon, Mickley	4·69	,,	Crossmolina, Enniscoe..	3·87
,,	Melmerly, Baldersby ...	4·10	,,	Collooney, Markree Obs.	4·06
,,	Scarborough, South Cliff	4·98	,,	Ballinamore, Lawderdale	2·77
,,	Middleton, Mickleton..	2·39	XXIII.	Lough Sheelin, Arley ..	2·29
X.	Haltwhistle, Unthank..	2·43	,,	Warrenpoint	2·50
,,	Bamburgh.....	3·28	,,	Seaforde	3·57
,,	Keswick, The Beeches...	4·65	,,	Belfast, Springfield	3·10
XI.	Llanfrechfa Grange	5·25	,,	Bushmills, Dundarave...	2·68
,,	Llandovery	4·58	,,	Stewartstown	3·27
,,	Castle Malgwyn	...	,,	Buncrana	3·50
,,	Builth, Abergwessin Vic.	7·01	,,	LoughSwilly, Carrablagh	3·43
,,	Rhayader, Nantgwillt..	6·79			

‡ Snow probably blown out of the gauge.

JANUARY, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·96	+ ·34	·75	19	16	51·9	20	20·2	30	21	2[illegible]
II.		Maidstone (Hunton Court)...	2·16	+ ·61	·30	19	23	...	...	...	...	...	...
,,		Strathfield Turgiss	2·55	+ ·74	·68	19	18	52·2	20	19·1	29	18	2[illegible]
III.		Hitchin	2·69	+ 1·15	·85	19	21	48·0	20	14·0	28	23	...
,,		Winslow (Addington)	2·51	+ ·70	·73	19	21	44·0	18	11·0	29	24	27
IV.		Bury St. Edmunds (Westley)	2·87	+ 1·40	·84	19	23	48·0	20	7·0	26	...	...
,,		Norwich (Brundall)	3·44	...	·54	19	27	45·0	16	9·5	27	20	27
V.		Weymouth(LangtonHerring)	4·07	+ 1·73	1·44	12	16	50·0	16	20·0	27	21	...
,,		Torquay (Cary Green)	4·10	...	1·27	12	20	51·6	20	23·2	28	16	24
,,		Polapit Tamar [Launceston]..	4·09	+ 1·07	·59	19	19	52·5	18	18·0	29	14	25
VI.		Stroud (Upfield)	3·22	+ 1·02	·65	19	18	45·0	17	19·0	10	26	...
,,		ChurchStretton(Woolstaston)	4·51	+ 2·35	·67	20	22	40·5	18	12·0	12	26	30
,,		Tenbury (Orleton)	4·37	+ 2·23	1·05	20	18	45·0	24	12·0	30	24	28
VII.		Leicester (Barkby)	3·08	+ 1·32	·99	20	24	45·0	19	4·0	28	27	31
,,		Boston	3·07	+ 1·68	·61	20	24	47·0	18	13·0	12	23	...
,,		Hesley Hall [Tickhill].....	3·00	+ 1·23	·67	20	20	38·0	20	0·9	12	26	...
VIII.		Manchester(PlymouthGrove)	2·64	+ ·18	·48	16	16	44·0	23*c*	18·0	29	23	...
IX.		Wetherby (Ribston Hall) ..	2·94	+ 1·05	·56	20	15	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·51	— 1·13	·65	16	23	...	...	...	...	...	...
,,		Hull (PearsonPark)	4·62	+ 2·85	·83	6	26	41·0	*b*	12·0	11*d*	27	28
X.		Newcastle (Town Moor)	5·28	+ 3·47	·77	7	22	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	5·89	— 6·29	·83	23	17	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·74	+ 1·45	·68	19*a*	19	...	...	...	...	...	...
,,		Haverfordwest	5·46	+ 1·04	·91	20	24	46·2	19	14·3	29	13	23
,,		Aberystwith (Gogerddan) ...	3·40	— ·13	·53	2	14	47·0	16	10·0	27	28	...
,,		Llandudno.....	2·51	+ ·23	·43	20	22	45·0	16	24·8	27	...	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·27	— 1·50	·38	16	14	42·2	23	12·0	28	26	...
,,		Jedburgh (Sunnyside).....	2·79	+ 1·07	·99	14	...	41·0	22	0·0	11	30	...
XIV.		Colmonell	2·00	...	·31	23	15	48·0	23	10·0	27	23	...
XV.		Lochgilphead (Kilmory).....	1·85	— 4·29	·42	22	11	...	...	14·0	27	28	...
,,		Mull (Quinish).....	1·70	— 3·97	·41	6	8	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·70	— ·20	1·20	15	9	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·90	+ ·93	·85	13	19	42·4	23	13·1	11	26	...
XVII.		Braemar	3·34	+ ·65	·60	13	22	38·0	23	—5·0	9	29	31
,,		Aberdeen (Cranford)	5·13	...	1·45	17	25	42·0	14*g*	5·0	10	24	...
XVIII		Strathconan [Beauly]	4·58	— ·30	1·60	1	...	...	...	...	...	...	...
,,		Glencarron Lodge.....	5·70	...	·85	1	17	42·1	23	9·1	28	30	...
,,		Cawdor [Nairn]	2·85	+ ·68	·59	18	22	...	...	...	...	..	...
XIX.		Dunrobin	3·28	+ ·82	·95	16	19	44·2	19	18·5	8*e*	21	...
,,		S. Ronaldsay (Roeberry).....	3·04	+ ·09	·34	6	28	47·0	18	23·0	27	20	...
XX.	IRELAND.	Darrynane Abbey.....	5·45	...	·76	12	23	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	5·76	+ 2·20	1·16	15	18	48·0	14	21·0	9*f*	19	...
,,		O'Briensbridge (Ross)	3·11	...	·58	5	16	...	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	4·34	+ 1·44	·89	12	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	5·71	+ 3·85	1·80	12	24	44·8	22	16·9	9	18	29
XXII.		Ballinasloe	2·38	— ·70	·56	5	23	43·0	12*c*	14·0	10	29	...
,,		Clifden (Kylemore)	6·23	...	1·32	11	24	...	...	...	...	...	...
XXIII		Waringstown	2·87	+ ·22	·90	12	23	45·0	22	12·0	27	26	30
,,		Londonderry (Creggan Res.).	3·99	+ ·57	·61	2	23	...	...	...	...	..	...
,,		Omagh (Edenfel)	2·86	— ·16	·60	12	19	44·0	22	19·0	26	23	30

a And 20. *b Various.* *c And 24.* *d And 12.* *e And 9, 11.* *f And 26.* *g And 16, 19.*

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—At the beginning of the month the temp. was considerably below the mean with slight falls of R or S, and this continued during the second week, but with rather more sunshine. The end of the month was very cold and snowy. Gales on 12th and 23rd.

ADDINGTON.—January opened with a sharp frost, and frost was registered in the shade on twenty-four days, very sharp on the 10th, 11th and 12th, and again from the 26th to the end. From the 12th until the 18th the bar. was very low, particularly on the 13th, 14th and 16th. Dense fog on the 10th; a large flood on the 20th.

BURY ST. EDMUNDS.—A month of real winter, only six days without frost. S on 17 days, mostly in small quantities. A blizzard on 31st, with distant thunder.

NORWICH, BRUNDALL.—A very winterly month; not one mild day, and S recorded on 18 days. Some very rough, coarse weather at times. Mean temp. 32°·8, the lowest since 1881, except 1891, which was 0°·4 lower. The ground was completely covered with S from December 30th to January 15th, and from January 22nd to 31st. T at 4 p.m. on 17th.

LANGTON HERRING.—A bitterly cold month. Mean 9 a.m. temp. 32°·7; only two months in the last 23 years have had a lower 9 a.m. mean, January 1881 29°·9, December 1890 31°·0. On 19 nights temp. fell to or below 30°, and on the last six nights to or below 23°. The heavy R on 12th was followed by 5 days of very low bar. On the 14th there were two very loud sharp claps of T with vivid L. At the end the ground was covered with about 3 inches of S; there was very little drift.

TORQUAY, CARY GREEN.—Rainfall ·70 in. above, mean temp. 37°·0 or 4°·0 below, and duration of sunshine 19 hours above, the average; six sunless days.

POLAPIT TAMAR.—Wetter than usual and very cold, the mean min. in shade being 32°·2, and on grass 25°·1. From the 13th to the 17th inclusive the bar. remained below 29 in., an unusual length of time to remain so low and remarkable for being free from gales. T on 27th.

STROUD, UPFIELD.—S drifted much on the 12th and some roads were impassible.

WOOLSTASTON.—A very severe month. S fell heavily on 13 days, blocking the roads, and the cold was intense. There was a furious gale on the 12th, causing huge drifts, in one of which a woman was lost on 24th and frozen to death. No such fall of S has occurred since 1865. Mean temp. 30°3.

TENBURY, ORLETON.—The coldest January since 1881. Great gale and S storm on the night of 12th, the depth being about 1 foot, and in drifts from 6 ft. to 10 ft. Very wet with floods between 12th and 20th, 3·91 in. of R and S falling in the 9 days. Intense frost set in on 26th and continued to the end of the month.

LEICESTER, BARKBY.—A very cold, winterly, wet and boisterous month. It seems to have been colder here than anywhere else in England. Mean max. temp. 36°·7, mean min. temp. 22°·4. From 7th to 11th inclusive the min. temp. was never above 15°. The Leicester water famine is at an end. (I expect the cold weather to continue for some time, at least 10 days.—E. N. POCHIN, Feb. 1st, 1895.)

WALES.

HAVERFORDWEST.—January commenced with wet weather, and some S and sleet on the 3rd; the weather became more wintry on the 5th, with N.E. wind. S fell at night, and heavily next day, followed by keen frost and changeable cold weather. On the 11th very stormy, cold weather set in, wind E., rising

to a gale at night, with heavy S, the gale and S continuing till 13th. A rapid thaw occurred on 15th, and cold R, freezing as it fell, on 16th, the weather remaining variable till 20th. The remainder was most winterly, with several deep falls of S, and gales on 24th and 25th, and 27th and 28th. The Precelly range was covered with S nearly the whole month.

ABERYSTWITH, GOGERDDAN.—Severe frost set in on 26th, with about a foot of S on that and the two following days.

SCOTLAND.

CARGEN.—The mean temp. of the month, 30°·8, is 7°·3 below the average, and the lowest recorded in January since observations commenced 35 years since. With the exception of December, 1878, when the mean temp. was 29°·2 this is the coldest month recorded. The first and latter parts of the month were extremely cold; from the 13th to the 23rd was somewhat milder, the mean temp. being 34°·6. The rainfall of this period was about an inch, the rest of the fall for the month being nearly all S, which was 6 inches deep on 28th. N. to E. winds prevailed for 29 days. The duration of sunshine was much above the average, and there was little fog.

JEDBURGH, SUNNYSIDE.—The temp. was extremely low throughout, and all outdoor work was suspended. S fell more or less almost every day, but there was little drifting, and the trains arrived at the normal times.

COLMONELL.—Rainfall 2·94 in. below the average, 1876–94. Mean temp. 32°·6, 3°·9 below the average. Falls of S were frequent at the beginning and end of the month, about 2 inches falling on 13th, and 2¾ inches on 26th.

BRAEMAR.—A month to be remembered for intensity of frost and almost incessant S and drifts. All traffic by sleigh only.

GLENCARRON.—A very severe month, with wind, S, and hard frost.

ROEBERRY.—A very coarse, cold month. Mean temp. 35°·2.

IRELAND.

O'BRIENSBRIDGE, ROSS.—Sharp frost, with light S showers in the first week; a gale from S.E. on 11th, followed by dull and cold weather up to the 19th, the cold increasing in intensity from that date to the end.

DUBLIN.—A very severe month, with much S and frost, alternating with frequent thaws. The coldest January since 1881, and as regards rainfall a record month. The precipitation was chiefly S, sleet, or H, the total being more than double the average, and 1·39 in. in excess of the fall in January, 1877, the next wettest. The mean temp., 35°·4, is 6°·0 below the average.

WARINGSTOWN.—An unusually severe month; roads blocked in many places on 12th and 13th.

EDENFEL.—January, 1895, has been marked by every unpleasant characteristic. Polar and easterly winds blew on 29 days, sometimes with the force of a gale, accompanied by light drifting S, with which the ground was more or less covered on every day of the month. Although it froze more or less keenly on every night but one, and the mean temp. was very low, but few days passed without a temporary thaw setting in for an hour or two. The R for the month, 2·86 in., is almost all melted S, of which the heaviest fall since January, 1881, took place on the 12th.

NOTICES.

It is requested that all Books for Review, and Comm
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letters published in this Magazine rests with their respectiv

THE OBSERVATO

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., S
(*Savilian Professor of Astronomy.*)

T. LEWIS, F.R.A.S., AND H. P. HOLLIS, F

Contains full Reports of the Meetings of the Royal Astr
Meteorological Societies, and of the British Astronomical A
by various eminent Astronomers, English, American
Correspondence on topics of interest connected with the
Observatories, Publications and current Discoveries.
Variable Stars, on Lunar Formations, etc., also are supp
and direction of observers.

The Observatory was founded in 1877, and has become an adv
publication.—*Prof. Young*, in "*Ten Years' progress in Astronomy*"

All communications should be addressed to the Editors
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Annual Subscription (for the "Companion" and twelve

SYMONS'S
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THE FROST OF JANUARY AND FEBRUARY, 1895.

WE cannot speak for others, but to us one lesson which experience is teaching is that in meteorological phenomena duration is of equal importance with intensity.

Our recent work in connection with the floods of last winter has shown us that it is not merely the extreme height reached which has to be considered, but the hours during which the river was in flood.

So with the recent frost, severe as it was, the most remarkable feature seems to have been, not the low temperature reached, but the duration of the intense cold. Taking, as one is apt to do, their own records as an illustration, the absolute minimum on the Glaisher stand at Camden Square, and by far the lowest recorded there in February during the 36 years 1859-95, was 7°·3 on February 8th, and (with the exceptions of December 25th, 1860, and January 5th, 1867, when the temperature fell to 6°·7) the lowest recorded in any month.

Concerning the distribution of the intensity of the cold over the country generally, Mr. F. Campbell Bayard, LL.M., has undertaken to read a paper before the Royal Meteorological Society, and therefore we have handed over to him the information which we have received. We may, however, mention that we have heard of readings in Stevenson's screens of −17° at Braemar, Aberdeen; of −13° at Esthwaite, Lancashire; of −8° at Bromley, Kent, and at Ketton, Rutland; and of −5° at Loughborough. Other low readings will be found in the table on page 34. We think that the Loughborough record for the following ten days will not be easily beaten.

	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	Mean
Min.	10	8	2	—5	—4	—1	1	4	2	4	2·1
8 a.m.	16	11	12	—4	1	1	24	7	4	9	8·1
Max.	30	28	30	26	26	29	33	39	38	30	30·9
6 p.m.	24	18	18	20	18	25	25	26	26	23	22·3

This gives for the mean temperature of the ten days 16°·5.

The following are minima at Greenwich below 10°, and it will be noted that 1895 is the only year with two such entries, and that they are on consecutive days.

	°		°		°
1820, Jan. 15th,	0·0	1845, Feb. 11th,	7·7	1870, Dec. 25th,	9·8
1838, Jan. 20th,	—4·0	1860, Dec. 25th,	8·0	1895, Feb. 7th,	9·6
1841, Jan. 8th,	4·0	1867, Jan. 5th,	6·6	,, ,, 8th,	6·9

Therefore, as regards absolute minimum temperature, 1895 was surpassed at Camden Square by 1860 and 1867, and at Greenwich by 1820, 1838, 1841 and 1867.

The following are mean daily temperatures at Greenwich below 20° :—

	°		°		°
1814, Jan. 10th,	19·6	1830, Jan. 18th,	18·1	1841, Jan. 7th,	17·4
1815, Jan. 14th,	16·2	,, Feb. 2nd,	17·0	,, ,, 8th,	12·8
1816, Feb. 8th,	19·7	,, ,, 3rd,	19·2	,, Feb. 3rd,	19·2
,, ,, 9th,	12·6	,, ,, 5th,	19·0	1845, ,, 12th,	19·2
1820, Jan. 1st,	19·9	,, ,, 6th,	18·7	1867, Jan. 4th,	13·2
,, ,, 13th,	18·7	,, Dec. 24th,	18·4	,, ,, 14th,	19·3
,, ,, 15th,	14·6	,, ,, 25th,	18·6	1881, ,, 15th,	19·8
1823, ,, 19th,	13·4	1838, Jan. 12th,	16·8	1890, Dec. 22nd,	19·5
1826, ,, 14th,	19·5	,, ,, 15th,	6 2	1891, Jan. 10th,	18·4
,, ,, 15th,	18·4	,, ,, 19th,	17·0	1895, Feb. 6th,	19·4
,, ,, 16th,	18·9	,, ,, 20th,	10·7	,, ,, 7th,	18·3
				,, ,, 8th,	18·9
				,, ,, 9th,	18·0

In this list there are in the 81 years twelve days colder (lower mean daily temperature) than any one day in 1895, there are three cases of two consecutive days colder than any two consecutive days in 1895, and there is one case of three consecutive days each with a mean temperature below 20° ; but there is no case of four such days until we come to 1895.

We may test this question of duration in another form, *viz.*, as to the number of consecutive days on each of which the mean temperature was below 32°. No period is quoted unless it exceeded 10 days.

1814, Jan. 1st to 26th, 26	1870-1, Dec. 21st to Jan. 4th, 15
1823, Jan. 9th to 26th, 18	1881, Jan. 12th to 27th, 16
1838, Jan. 8th to 21st, 14	1890, Dec. 10th to 25th, 16
1855, Feb. 7th to 23rd, 17	1892-3, Dec. 24th to Jan. 7th, 15
1860, Dec. 18th to 29th, 12	1895, Jan. 25th to Feb. 18th, 25
1867, Jan. 12th to 22nd, 11	

As regards mean temperature, there is no case equal to 1895 with four consecutive days on each on which the mean temperature was below 20° ; the nearest approaches are—

1816	1826	1830	1838	1841	1895
°	°	°	°	°	°
Feb. 8, 19·7	Jan. 14, 19·5	Feb. 2 17·0	Jan. 12, 16·8	Jan. 7, 17·4	Feb. 6, 19·4
,, 9, 12·6	,, 15, 18·4	,, 3, 19·2	,, 15, 16·2	,, 8, 12·8	,, 7, 18·3
	,, 16, 18·9	,, 5, 19·0	,, 19, 17·0		,, 8, 18·9
		,, 6, 18·7	,, 20, 10·7		,, 9, 18·0

It may be thought strange that we have not dwelt upon the winter of 1855, January and February of which year much resembled the corresponding months of 1895. There was a great

similarity, but 1855 was not nearly so severe as 1895. The absolute minima in the two Januarys were very similar, but the minimum in February, 1855, was 11°·1 on the 19th, whereas in 1895 it was 6°·9 on the 8th; and the mean temperature of the coldest four consecutive days in 1855 (16th to 19th) was 22°·7; in 1895 the four days (6th to 9th) had a mean of only 18°·7.

Another striking proof of the severity of the 1895 frost is afforded by the temperature of the earth. The thermometer with its bulb 1 foot below the surface was first read at Camden Square on January 1st, 1871. Prior to 1895 it was never below 32°, and it reached that point in only 1880, when the 9 a.m. readings were—

January.			February.				
29th	30th	31st.	1st	2nd	3rd	4th	5th.
32·0	32·1	32·0	32·0	32·0	32·0	32·0	32·0

But in February, 1895, we have—

10th	11th	12th	13th	14th	15th	16th	17th	18th	19th
32·0	32·1	31·9	31·8	31·2	31·1	31·1	31·0	30·9	31·1

20th	21st	22nd	23rd	24th
31·6	31·8	31·9	31·9	32·0

There are therefore twelve consecutive days every one of which was cold beyond precedent since the observations began in 1871. This excess is, however, due to two causes—(1) the duration of the low air temperature, (2) the fact that there was very little snow—for a layer of snow 6 inches thick keeps the earth several degrees warmer than it would be without it.

Respecting earth temperatures and water pipes, we hope to be able to say something next month.

To the Editor of the Meteorological Magazine.

SIR,—In this district the great feature of the frost has been the very low depth of water in the wells. Some, never dry before, have been dry this year, and others, where there is generally an abundance of water, exhausted after a short pumping. The pits and streams are now full, but the wells are filling very slowly.—Yours truly,

S. W. JONES.

Salt Vicarage, Stafford, February 18th, 1895.

[This strikes us as extremely interesting. Apparently the surface of the ground was sealed by frost, and thereby the subsoil water was maintained at a constant level, being unable to run out of the soil, as the frozen surface prevented the entrance of air to take its place.—ED.]

To the Editor of the Meteorological Magazine.

SIR,—The great frost seems now to have broken up, but it will long be remembered. From December 30th to February 27th (60 days) the thermometer fell below 32° every night except four, which I think is a record. The mean temperature for the month was 28°·5, the lowest mean for February during the 23 years in which I have kept an account of the weather. The maximum on February 6th was only 22°, the lowest maximum I ever recorded.

The frost of 1881 was more severe, viz., —4°·0 (or —3°·0), according to different thermometers. My figures are from instruments in a Stevenson's screen at 4 feet from the ground, which I believe to be correct. I have tested them recently at freezing point. The rainfall for February was only ·26 in., including snow.—Yours truly,

S. KING.

Elswick Lodge, Garstang, March 1st, 1895.

P.S.—The 4 nights when the temp. was not below 32° were :—

January 14th	32°	January 19th	34°
,, 15th	32°	February 23rd	34°

Max. temp. in February	44°	Lowest max. in February	22°
Min. ,, ,, ...	7°	Highest min. ,, ...	36°*
Mean ,, ,, ...	28°·5	Nights of frost ,, ...	26

* Feb. 28th, not included in the 60 days.

To the Editor of the Meteorological Magazine.

SIR,—I send you a few particulars of the frost, which to-day seems to be at an end. – Yours truly,

CHARLES L. BROOK.

Harewood Lodge, March 6th, 1895.

FROST OF JANUARY—FEBRUARY, 1895.

(1.) This frost commenced December 27th, 1894, and ended March 6th, 1895, a period of 70 days.

(2.) During this time the minimum temperature on the ground was below 32°, except on March 1st, 33°·7, and January 15th, when it was exactly 32°.

(3.) The minimum temperature in a Stevenson's stand was *below* 32° on 59 nights out of 70, with a continuous period of 32 days from January 22nd to February 22nd inclusive.

(4.) From December 29th, 1894, to February 19th, 1895 (53 days) the maximum temperature in Stevenson's screen did not reach 40° (see Mr. Ryves' letter in your February number), the highest being 39°·2 on January 18th.

(5.) The thermometer at one foot below the surface was below the freezing point from February 11th–23rd (13 days).

(6.) The ground was frozen to the depth of 17 inches.

(7.) The ice on a large reservoir attained a maximum thickness of 13¾ inches.

The average temperatures for the months January and February were :—

	Max.	Min.	Mean.	Grass Ther.
January	34°·3	25°·1	29°·7	20°·0
February..	33°·9	21°·7	27°·8	14°·9

The four coldest months I have registered in 16 years are :—

1.	February, 1895	27°·8
2.	January, 1881	29°·2
3. }	January, 1895	29°·7 }
4. }	December, 1890	29°·7 }

To the Editor of the Meteorological Magazine.

SIR,—The following may be of interest:—

TEMPERATURE OF FEBRUARY.

Mean of 13 years (1882–94)	39°·4
Mean of 1895	26°·9
Deficiency	12°·5

Lowest temp. registered February 8th—
In screen —3°·0 a record.
On grass 5°·0
Mean temp. of 8th —9°·0 a record.
Mean temp. Feb. 6th–10th, inclusive ... 14°·9

Rain fell on 3 days—max., 1st, ·13 in.; total ·17 in. Absolute drought, 2nd to 23rd inclusive; partial drought, whole month. February is the month in which I generally record minima of rainfall:—

	Rain fell on	Total.
1887	10 days	·51 in.
1888	13 ,,	·44 ,,
1890	9 ,,	·58 ,,
1891	1 ,,	·02 ,,
1895	3 ,,	·17 ,,

Yours faithfully,

R. J. ROBERTS.

Pool Quay Vicarage, Welshpool, March 1st, 1895.

To the Editor of the Meteorological Magazine.

SIR,—Referring to the absence, as far as I have seen in the profuse literature upon the late weather, of any reference to the curious variation of minimum temperature indicated by thermometers placed at different local elevations, though comparatively close, I append a record of such readings here for the week ending 12th February, No. 1 Thermometer being placed in the screen, No. 2 on the surface of the snow close by, and No. 3 about 200 yards off and in a hollow of the ground, at a lower elevation of about 50 feet (about 250 ft. above sea level):—

	No. 1.	No. 2.	No. 3.		No. 1.	No. 2.	No. 3.
	°	°	°		°	°	°
Feb. 6th	5	2	—12	Feb. 10th	17	12	—1
,, 7th	13	8	— 6	,, 11th	7	4	—8
,, 8th	12	5	— 8	,, 12th	14	10	5
,, 9th	16	14	9				

These instruments have Kew certificates, and have lately been thoroughly tested.—Yours very truly,

L. M. BUCHANAN
(Colonel).

Edenfel, Omagh, Tyrone, March 3rd, 1895.

RECENT DRY FEBRUARIES.

To the Editor of the Meteorological Magazine.

SIR,—The extremely small rainfall of the February just past, coming only four years after an absolutely rainless February in 1891; led me to take out the average of February for the 10 years 1886–1895 the result is remarkable, being 1·23 in. only, or about two-thirds of the *true* average, by which I mean an average of 20 years or more. In these 10 years, which is the extent of the record of rainfall here, there have been five years in which the total of February has been less than one inch, viz. :—

1886.....	0·68 in.	1890.....	1·05 in.	both below the true average.
1887.....	0·62 ,, ...	1892.....	1·62 ,,	
1888.....	0·93 ,, ...	1894.....	1·82 ,,	about the true average or slightly under.
1891.....	0·00 ,, ...	1889..... ..	2·34 ,,	both above the true average.
1895.....	0·12 ,, ...	1893.....	3·12 ,,	

Thus we have seven, if not eight years, with a deficient rainfall in February, and only two years with an excess. Though the gauge has been kept here only 10 years, at Muswell Hill, two miles S.E. of this place, we have a record for 23 years, 1872–1894; the average of February for that period is 1·91 in., while the 10 years average there (1886–95) is 1·22 in., differing only ·01 in. from the average for the same period here; thus the 10 years' average is 0·69 in., or 36 per cent. less than the 23 years' average. On examining the preceding 10 years, 1876–1885, we find the average is 2·61 in., or 0·70 in. above the 23 years' average, showing that we may expect that any great departure from the true average in one decade will be rectified by a corresponding difference the other way in the following one; it also seems to show that 10 years is not a sufficiently long period to take as an average for the month, though it may be so for the year. The following are the totals of February at Muswell Hill for the 20 years, 1876-1895 :—

10 years, 1876–1885.	in.
1876	2·14
1877	1·80
1878	1·64
1879	3·97
1880	2·36
1881	4·03
1882	1·44
1883	3·95
1884	1·52
1885	3·27
	26·12
Average ...	2·61

10 years, 1886–95.	in.
1886	0·65
1887	0·69
1888	0·97
1889	2·25
1890	1·15
1891	0·00
1892	1·47
1893	3·05
1894	1·81
1895	0·14
	12·18
Average ...	1·22

Yours truly,

J. W. SCOTT.

Elleray, Etchingham Park, Finchley, Middlesex, March 7th, 1895.

SNOW FROM A CLOUDLESS SKY.

To the Editor of the Meteorological Magazine.

SIR,—On the 6th February, at 9 a.m., light snow began to fall, sparkling in sunshine from a cloudless sky. Thinking that the snow might be blown off a roof, I went out on the common, clear of houses, and made no doubt that the fall was from the sky. Gradually it clouded over, and at 10 a.m. was quite overcast, the snow continuing as a natural shower for a short time longer.

J. P. MACLEAR.

Cranleigh, Surrey, 21st February, 1895.

UNUSUAL SNOW CRYSTALS.

To the Editor of the Meteorological Magazine.

SIR,—On February 14th, between 8 a.m. and 8.30 a.m., snow fell in single crystals of large size, the shade temp. at the time being 21° or 22°. I devoted half an hour to measuring the largest, and succeeded in beating my previous record, the two largest measuring $\frac{11}{24}$ in. and three others $\frac{10}{24}$ in.—Truly yours,

H. SOWERBY WALLIS.

25, *Northwood Road, Highgate, February 21st*, 1895.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society, was held on Wednesday evening, February 20th, at the Institution of Civil Engineers, 25, Great George-street, S.W., Mr. R. Inwards, F.R.A.S., President, in the chair.

After the transaction of formal business, Captain Wilson Barker exhibited some lantern photographs taken from the ship *Worcester* at Greenhithe, showing the ice on the Thames, some blocks being 10 ft. thick. It was necessary to rig up rocket apparatus to maintain communication with the shore, as it was impossible during the greater part of each day for boats to navigate the water. Mr. W. Marriott also had taken photographs from Westminster bridge, which showed the water completely covered with ice.

Mr. E. Mawley presented his report on the phenological observations for 1894. Between the third week in March and the third week in May, plants generally came into blossom in advance of their usual time, and towards the end of April the dates of first flowering differed but little from those recorded at the same period in the very forward spring of 1893. The cuckoo was heard even earlier than in the previous year. The year 1894 was a very productive one, and both the hay and corn crops proved unusually heavy, but much of the latter was harvested under very trying conditions as regards weather. The frosts of May 21st and 22nd entirely destroyed the

previous prospect of a glorious fruit season. Indeed, the only really good crop was that of pears, which were singularly abundant throughout nearly the whole of England.

The paper was illustrated by a diagram showing the mean dates of flowering of certain plants in 1894, in different parts of the British Isles, compared with the average.

Dr. Buchan spoke of the great value of the records, and mentioned that in 1894 Shetland was the earliest district of the British Isles in which grain ripened, the harvest having been the earliest ever known. The damage done by the May frost was extremely irregular; he believed that a very few days difference in the state of the blossom greatly affected the result.

Mr. Symons appreciated the manner in which Mr. Mawley marshalled his statistics, and thought that the table of averages proved the excellence of the observations. The President and Mr. Bayard also took part in the discussion. Admiral Maclear said that many gardeners attributed the damage in the May frost to the sun shining on the vegetation before it thawed, and considered that watering would have mitigated the injury, instancing the parallel case of rapidly thawing a frost-bitten member in man.

Mr. Mawley in replying considered that variations of soil were of great importance in frost in winter, but not in spring frosts; that there was no doubt as to the efficacy of slowly thawing, and that it was a recognised practice with rosarians in case of frost to syringe their roses before sunrise. Blossom once fertilized was much less susceptible to injury.

Mr. W. Marriott gave an account of the thunderstorm and squall which burst over London suddenly on the morning of January 23rd. He considers that this storm passed across England in a south south-easterly direction at the rate of about 47 miles an hour, being over Northumberland at 4 a.m., and reaching the English Channel by 11 a.m. Thunder was first heard in the vicinity of Leeds, and accompanied the storm in its progress across the country. One of the most remarkable features of the storm was the sudden increase in the force of the wind; for in London it rose almost at one bound from nearly a calm to a velocity of 36 miles an hour. This sudden increase of wind caused considerable damage, and at Bramley, near Guildford, twenty-eight trees were blown down along a track 1860 yards in length.

Dr. Preller spoke of the growing importance of records of atmospheric discharges in connection with the increased commercial use of electricity, and said that he knew of no country in which records were kept in such a form as to be of use to the electrician. He believed that thunderstorms showed a maximum frequency in the areas of maximum magnetic force mapped out by Prof. Rücker.

Mr. Bayard asked if in winter, thunderstorms similar to that described the path of the storm bore a constant relation to the position of the areas of low pressure.

Dr. Buchan spoke of the nearness of the lightning, and referred to the great darkness in spite of the absence of fog; he attributed the darkness to two currents of air differing greatly in temperature and humidity. With reference to the relation to cyclones the secondary was always on the right of the primary, and the thunderstorm was connected with the secondary.

Mr. Symons said that he believed that injury by lightning was very frequent in Northamptonshire, and that Devon and Cornwall were comparatively exempt from injury. He was inclined to think that the character of the soil played some part in inducing areas of thunderstorm injury. The short time-interval between the lightning and thunder appeared to be a feature of the storm under discussion.

Mr. H. S. Eaton saw the storm approaching, and noticed the cumulo-stratus which is so good an indication of an approaching thunderstorm.

Mr. Sowerby Wallis said that nearly everyone who described this storm spoke of the nearness of the lightning, and it appeared that lightning was not seen or thunder heard at distances much exceeding a mile; he thought that the two strata of air of very different temperature and humidity mentioned by Dr. Buchan as the cause of the darkness would account for this also.

Mr. W. Marriott said that winter thunderstorms travel with the wind, and are therefore controlled by the position of the cyclone, that under discussion being clearly of the tornado type. Summer thunderstorms generally travel along the lowest ground.

Mr. A. B. MacDowall's paper on "Some gradual weather changes in certain months at Greenwich and Geneva," was read by the Secretary.

BAROMETRIC UNDULATIONS.

To the Editor of the Meteorological Magazine.

SIR,—Barometric undulations such as those represented by Mr. Backhouse on p. 179, are of very frequent occurence at the Blue Hill Meteorological Observatory, and occur both during quiet and windy weather. Marked examples are reproduced, and described in the "Results of the Meteorological Observations made at the Blue Hill Meteorological Observatory, Mass,. U.S.A., in the year 1886," and in the "Observations made at the Blue Hill Meteorological Observatory, Mass., U.S.A., in the year 1887;—Annals of the Astronomical Observatory of Harvard College, Vol. XX, Part I." A detailed discussion of these undulations is made in the volume of Blue Hill Observations for 1893,—"Annals of the Astronomical Observatory of Harvard College Vol. XL. Part III" pp 195 to 202. The conclusion arrived at there is that the observations fully sustain Helmholtz's conclusion that the barometric undulations are the result

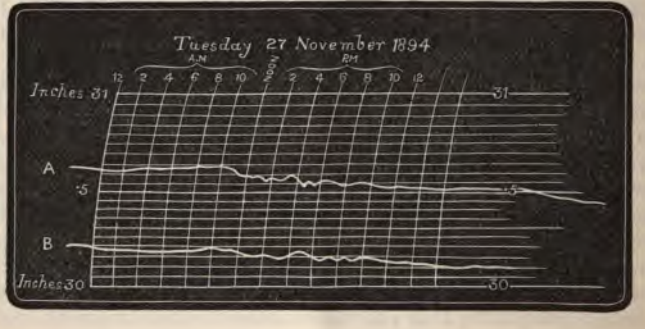
of real gigantic waves in the atmosphere like the waves in the ocean which are brought about by friction between atmospheric strata of different densities moving in different directions and with different velocities. These atmospheric waves are of all sizes, from the minutest ripple to the gigantic billows which affect the barometer, and have a very much greater influence in determining the conditions of the sky and weather than has heretofore been supposed. The parallel rows of clouds, the cloud furrows and striations, the rhythmic clearing and clouding at short intervals sometimes observed are all indications of the frequent existence of these waves. Their influence is felt in the precipitation, in the wind, and in the temperature oscillations of short periods, all of which at times show undoubted wave-like fluctuations.

In New England the barometric waves were all found to move from west to east, which is probably the general direction of motion of these waves north of the tropics, because the upper currents, which drive across and kick up waves in the lower currents, usually move from the west.

H. HELM CLAYTON.

Blue Hill Meteorological Observatory, February 7th, 1895.

[Mr. Clayton has conferred a benefit upon our readers by referring them to his paper upon the subject in the publication quoted. It seems to us that he has dealt chiefly with storm phenomena, for out of 78 occurrences on only one was the velocity of the wind below ten miles an hour. We had not previously read the explanation by Von Helmholtz, and it is not for us to question the *dicta* of so great a man, however difficult we may find it to understand them. We have been favoured with the tracing of the barograph at Skelwith Fold, Ambleside, for the same calm day, so reproduce the block with the extra curve, drawn however (for the sake of clearness) half-an-inch too low.]



REVIEW.

The Climatology and Physical Features of Maryland. First Biennial Report of the Maryland State Weather Service, for the years 1892 and 1893. Baltimore: 1894. Royal 8vo, 140 pages, six plates.

THIS well-printed modern American book is peculiar in several respects. It is an unusual size—a full page measuring 7·20 in. by 4·66 in.—but it has no signatures. Have our American friends discovered that they are superfluities? Then it has no publisher, unless we are to infer from its second title that it is issued from the Weather Service Office, in the Johns Hopkins University in Baltimore. We infer from the reports of the Director and of the Treasurer that the volume is not intended for sale but for free distribution as one means of "setting forth the advantages of the State from a climatic standpoint." We see further that no portion of the appropriation of two thousand dollars (say £400) granted by the State is to be paid for editorial work, and that there is a heading in small type, "U.S. Department of Agriculture, Weather Bureau." So we take it that the volume is really a local record of Maryland Weather prepared at the joint cost of the Weather Bureau and of the State of Maryland.

We have had to investigate this, because while we in no way whatever impugn the absolute impartiality of the writers of this report, we have had painful experience of the weakness of human nature when persons interested have written accounts of the localities in which they reside. A pamphlet which we recently received but have not noticed has shown us that this evil has followed civilization across the Atlantic, and we trust that Prof. Harrington will be on guard against its finding any home in the publications of his Bureau. Confidence once destroyed can never be repaired.

The first three chapters, devoted respectively to Topography, Geology, and Agriculture, seem to us good and practical. But we cannot say much for the one devoted to Climate. There are extremely pretty maps, and there are sundry tables, like those on pages 57 and 58, which look as if they represented the result of long and well organised work, but when closely examined it seems (though we hope that it is not really so) as if all these maps and tables, and the generalizations made with much positiveness, rest on the observations made during *the year* 1892 and part of 1893. There are, on pages 65 and 66, two lines of figures exempt from this criticism, but as far as we can see there are no others.

Isotherms and hyetographic shading based upon less than two years observations may look pretty, but they are not worthy of being printed, not worthy of being criticized, not worthy of the country which has given to Meteorology Loomis and Ferrel.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	79·3	14	63·1	21	69·2	53·3	52·7	78	124·9	41·9	2·85	18	7·1
Malta	95·2	30	65·2	23	86·4	70·1	66·3	69	147·5	60·2	·00	0	0·6
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	78·4	27	58·2	1	74·8	64·8	60·3	74	127·6	49·3	2·09	22	5·8
Calcutta	90·6	29	75·2	20	86·2	77·9	78·4	88	157·2	74·7	4·82	16	8·0
Bombay	87·2	27	74·0	30	84·7	77·3	75·5	84	140·3	72·2	8·40	28	8·9
Ceylon, Colombo	85·6	18	70·0	29	84·3	77·0	70·6	75	146·0	66·0	·86	12	6·6
Melbourne	69·7	21	34·1	4	58·1	44·2	44·3	78	120·2	27·0	1·96	17	7·3
Adelaide	68·4	19	39·2	14	60·9	47·5	45·7	75	132·3	33·0	2·92	17	6·3
Sydney	71·3	26	41·6	9	62·1	47·8	43·6	73	118·7	28·3	1·14	10	3·7
Wellington	65·0	25	33·3	6	54·9	43·8	42·8	79	109·0	21·0	5·61	15	5·3
Auckland	63·0	27	40·0	6	58·5	46·1	45·3	77	125·0	35·0	5·95	23	6·0
Jamaica, Kingston	92·5	20	70·2	12	89·8	72·9	70·6	72	...	...	1·31	5	5·1
Grenada	87·2	13	71·8	1	83·6	75·4	72·5	80	156·5	...	6·78	25	4·0
Trinidad	91·0	*	67·0	6	87·5	71·1	71·3	83	171·0	67·0	12·06	22	...
Toronto	85·1	8	46·3	21	75·5	55·7	52·8	66	...	45·9	·38	5	5·7
New Brunswick, Fredericton	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	92·1	22	37·5	14	80·3	50·8	...	...	...	...	·77	12	4·1
British Columbia, Esquimalt	80·2	28	47·7	9	69·3	50·8	53·7	83	...	...	·25	4	3·3

*Various.

REMARKS.

MALTA.—Adopted mean temp. 77°·4, 1°·0 below the averoge. Mean hourly velocity of wind 7·9 miles. Sea temp. ranged between 78°·5 and 79°·5. Lightning seen on 26th and 27th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·4 above, of dew point 1°·1 above, and rainfall ·07 in. below, their respective averages. Mean hourly velocity of wind 13·4 miles or 1·1 above average; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

Adelaide.—Mean temp. 0°·2 above average. Over the Southern parts of the Colony good rains fell, exceeding the average at most stations, and the Northern areas, where it has been so dry since the beginning of the year, during the latter part of the month received moderate and welcome rains. C. TODD, F.R.S.

Sydney.—Temp. 0°·1 below, and rainfall 1·78 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—The first half of the month was generally showery, with moderate winds from S.E. and N.W.; then fine up to the 27th, but strong N.W. winds on 24th, 25th, 27th and 28th; showery for the remainder of the month. Thunder on 29th; fog on 1st and 2nd; hail on 4th; brilliant aurora on 20th. Mean temp. 1°·3 above, and rainfall ·41 in. above, the average. R. B. GORE.

Auckland.—Stormy, showery and unpleasant through the greater part of the month. Mean temp. slightly below the average; rainfall largely in excess, being 1·68 in. above the average. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 3·8 miles. Kingston rainfall about one-fourth, Island rainfall about one-half, of the average. Lunar rainbow seen at Kingston on 18th. R. JOHNSTONE.

TRINIDAD.—Rainfall 1·74 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	·20	XI.	Lake Vyrnwy	1·01
,,	Birchington, Thor	·68	,,	Corwen, Rhug	·20
,,	Hailsham	·22	,,	Carnarvon, Cocksidia ...	·24
,,	Ryde, Thornbrough	·11	,,	I. of Man, Douglas	1·74
,,	Emsworth, Redlands ...	·06	XII.	Stoneykirk, Ardwell Ho.	1·75
,,	Alton, Ashdell.....	·11	,,	New Galloway, Glenlee	2·39
III.	Oxford, Magdalen Col...	·08	,,	Melrose, Abbey Gate ...	·71
,,	Banbury, Bloxham	·11	XIII.	N. Esk Res. [Penicuick]	·80
,,	Northampton, Sedgebrook	·11	,,	Edinburgh, Blacket Pl..	·56
,,	Alconbury	·11	XIV.	Glasgow, Queen's Park.	·14
,,	Wisbech, Bank House..	·32	XV.	Inverary, Newtown	·97
IV.	Southend	·58	,,	Islay, Gruinart School..	1·56
,,	Harlow, Sheering	·18	XVI.	Dollar.....	1·45
,,	Colchester, Lexden.....	·33	,,	Balquhidder, Stronvar..	·99
,,	Rendlesham Hall	·58	,,	Ballinluig	·94
,,	Diss	1·07	,,	Dalnaspidal H.R.S. ...	1·31
,,	Swaffham	·30	XVII.	Keith H.R.S.	·75
V.	Salisbury, Alderbury...	·10	,,	Forres H.R.S.	·83
,,	Bishop's Cannings	·26	XVIII.	Fearn, Lower Pitkerrie.	·83
,,	Blandford, Whatcombe .	·11	,,	Loch Shiel, Glenaladale	1·84
,,	Ashburton, Holne Vic....	·05	,,	N. Uist. Loch Maddy ...	·74
,,	Okehampton, Oaklands.	·14	,,	Invergarry	·45
,,	Hartland Abbey	·59	,,	Aviemore H.R.S.	·93
,,	Lynmouth, Glenthorne.	·12	,,	Loch Ness, Drumnadrochit	·83
,,	Probus, Lamellyn	·15	XIX.	Invershin	·24
,,	Wellington, Sunnyside..	·14	,,	Scourie	2·63
,,	Wincanton, Stowell Rec.	·18	,,	Watten H.R.S.	1·06
VI.	Clifton, Pembroke Road	·11	XX.	Dunmanway, Coolkelure	3·20
,,	Ross, The Graig	·04	,,	Fermoy, Gas Works ...	...
,,	Wem, Clive Vicarage ...	·36	,,	Killarney, Woodlawn ...	2·37
,,	Cheadle, The Heath Ho.	·19	,,	Caher, Duneske	·46
,,	Worcester, Diglis Lock	·18	,,	Ballingarry, Hazelfort...	·73
,,	Coventry, Coundon	·14	,,	Limerick, Kilcornan ...	·50
VII.	Ketton Hall [Stamford]	·25	,,	Ennis	...
,,	Grantham, Stainby	·30	,,	Miltown Malbay.....	1·24
,,	Horncastle, Bucknall ...	·30	XXI.	Gorey, Courtown House	·26
,,	Worksop, Hodsck Priory	·13	,,	Athlone, Twyford	·52
VIII.	Neston, Hinderton	·24	,,	Mullingar, Belvedere ...	·92
,,	Preston, Haighton	...	,,	Longford, Currygrane...	2·07
,,	Broughton-in-Furness..	1·24	XXII.	Woodlawn.....	·73
IX.	Ripon, Mickley	·43	,,	Crossmolina, Enniscoe..	·63
,,	Melmerly, Baldersby ...	·56	,,	Collooney, Markree Obs.	·49
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	·44
,,	Middleton, Mickleton..	1·78	XXIII.	Lough Sheelin, Arley ..	·35
X.	Haltwhistle, Unthank..	·71	,,	Warrenpoint	·54
,,	Bamburgh.....	1·74	,,	Seaforde	·69
,,	Keswick, The Beeches...	2·17	,,	Belfast, Springfield	1·40
XI.	Llanfrechfa Grange	·05	,,	Bushmills, Dundarave...	1·37
,,	Llandovery	·28	,,	Stewartstown	·43
,,	Castle Malgwyn	·15	,,	Buncrana	·80
,,	Builth, Abergwessin Vic.	·72	,,	Lough Swilly, Carrablagh	1·26
,,	Rhayader, Nantgwillt..	·47			

FEBRUARY, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	D
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	·12	— 1·76	·06	1	4	46·2	23	7·3	
II.		Maidstone (Hunton Court)...	·76	— 1·04	·35	5	6	...	...	...	
,,		Strathfield Turgiss	·18	— 1·82	·10	24	2	47·5	23	1·8	
III.		Hitchin	·21	— 1·54	·11	1	3	43·0	23	2·0	
,,		Winslow (Addington)	·16	— 2·00	·09	24	3	45·0	28	1·0	
IV.		Bury St. Edmunds (Westley)	·23	— 1·33	·09	24	3	43·0	23	—2·0	
,,		Norwich (Brundall)	·88	...	·17	24	18	45·8	23	4·0	
V.		Weymouth(LangtonHerring)	·02	— 2·58	·02	24	1	43·0	23	13·0	
,,		Torquay (Cary Green)	·01	...	·01	24	1	48·3	28	21·6	1
,,		Polapit Tamar [Launceston]..	·12	— 3·15	·08	24	4	48·0	28	11·5	1
VI.		Stroud (Upfield)	·12	— 2·44	·10	24	2	44·0	28	11·0	7
,,		ChurchStretton(Woolstaston)	·27	— 2·18	·15	1	4	45·5	24	8·0	
,,		Tenbury (Orleton)	·17	— 2·31	·11	24	2	46·3	28	—0·3	
VII.		Leicester (Barkby)	·15	— 1·66	·08	24	7	45·0	23*b*	—10·0	
,,		Boston	·53	— 1·15	·23	24	8	46·0	19	0·0	8,
,,		Hesley Hall [Tickhill].....	·14	— 1·36	·04	24	7	48·0	24	—1·0	
VIII.		Manchester(PlymouthGrove)	·36	— 1·69	·17	28	4	42·0	25*c*	12·0	
IX.		Wetherby (Ribston Hall) ...	·24	— 1·34	·15	1	3	...	...	...	
,,		Skipton (Arncliffe)	1·11	— 3·58	·36	28	6	...	...	...	
,,		Hull (PearsonPark)	·61	— 1·19	·25	24	15	45·0	22*d*	5·0	
X.		Newcastle (Town Moor)	1·12	— ·28	·34	1	12	...	...	...	
,,		Borrowdale (Seathwaite).....	2·18	—10·46	1·10	6	7	...	...	...	
XI.	WALES.	Cardiff (Ely).....	·19	— 3·00	·09	28	4	...	...	...	
,,		Haverfordwest	·12	— 4·00	·07	24	5	45·0	28	12·9	1
,,		Aberystwith (Gogerddan) ...	·23	— 3·03	·12	24	3	44·0	21	6·0	1
,,		Llandudno.....	·46	— 1·46	·21	28	6	44·0	28	17·5	
XII.	SCOTLAND.	Cargen [Dumfries]	1·08	— 2·57	1·08	7	1	46·4	21	—2·0	1
,,		Jedburgh (Sunnyside).....	·97	— ·54	·38	2	3	46·0	20*e*	—2·0	8,
XIV.		Colmonell	1·93	...	1·00	6	4	51·0	21	—1·0	1
XV.		Lochgilphead (Kilmory).....	1·12	— 4·07	·75	23	2	...	...	12·0	1
,,		Mull (Quinish).....	·43	— 5·04	·40	24	2	...	...	...	
XVI.		Loch Leven Sluices	1·00	— 1·75	·20	1*a*	5	...	...	...	
,,		Dundee (Eastern Necropolis)	·75	— 1·35	·25	6	11	48·2	28	4·0	1
XVII.		Braemar	·93	— 2·43	·22	28	13	41·0	28	—17·0	1
,,		Aberdeen (Cranford)	1·78	...	·60	5	15	48·0	28	0·0	
XVIII		Strathconan [Beauly]	3·37	— 1·34	·94	28	9	...	...	...	
,,		Glencarron Lodge.....	2·32	...	·94	28	13	43·7	21	8·6	1
,,		Cawdor [Nairn]	1·17	— 1·06	·33	28	10	...	...	...	
XIX.		Dunrobin	1·09	— 1·00	·35	28	7	46·0	28	16·5	1
,,		S. Ronaldsay (Roeberry).....	·97	— 1·67	·25	23	18	44·0	20*f*	19·0	
XX.	IRELAND.	Darrynane Abbey.....	3·88	...	1·00	6	9	...	...	...	
,,		Waterford (Brook Lodge) ...	1·15	— 2·93	·70	6	6	48·5	28	16·0	1
,,		O'Briensbridge (Ross)	·69	...	·48	6	6	...	...	...	
XXI.		Carlow (Browne's Hill)	·52	— 2·56	·20	1	6	...	..	9·0	1
,,		Dublin (FitzWilliam Square)	·62	— 1·73	·31	6	9	48·6	28	19·0	
XXII.		Ballinasloe	·87	— 1·91	·50	6	6	48·0	28	—5·0	
,,		Clifden (Kylemore)	1·51	...	·39	14	9	...	...	...	
XXIII		Waringstown	·63	— 1·82	·28	5	6	47·0	28	—1·0	
,,		Londonderry (Creggan Res.).	·80	— 2·23	·20	28	10	...	...	...	
,,		Omagh (Edenfel)	·51	— 2·18	·20	7	7	45·0	23	5·0	

a And 2, 3, 6, 28. b And 28. c And 26, 28. d And 23, 28. e And 21, 23. f And 22, 28. g

+*Shows that the fall was above the average*; —*that it was below it.*

METEOROLOGICAL NOTES ON FEBRUARY, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The driest and coldest February ever recorded at this station. All growth at an utter standstill, and no insects or birds moving.

HITCHIN.—Mean temp. 26°·5. The lowest ever recorded here during 45 years; 27°·0 has been twice recorded.

BURY ST. EDMUNDS.—This month and February 1886, which are both alike, have the smallest rainfall in February since observations first commenced in 1857. This is also the coldest month: the min. of the exposed ther. (1 foot above ground) not having been once above 30°. If it had not been for the heavy snow of January, and very little wind, much more damage would have been done to vegetation, which is not so much hurt as in 1860.

NORWICH, BRUNDALL.—A severely cold month; mean of max. and min. temp. 30°·3; which is only 0°·1 warmer than Decembr 1890. S on the ground on 25 days; in fact, with 8 days exception, the earth was continuously covered with a white mantle from December 30th to February 28th, a period of 61 days. The mean of the shade max. and. min. for the week ending 12th was 22°·4. 22°·4.

LANGTON HERRING.—On one day only did any R fall this month, which has broken many records. It has been by far the coldest month since observations began in 1872; the mean temp. at 9 a.m. (26°·9) being as much as 12°·3 below the average for February. Compared with the next coldest month in 23 years, viz., January 1881, and with the average for February for the 23 years we have:—

	Mean at 9 a.m.	Min.	Max.
February, 1895 ...	27°·0 ...	23°·7 ...	33°·8
January, 1881 ...	29°·9 ...	27°·8 ...	36°·0
February average ...	39°·3 ...	36°·0 ...	44°·8

Frost occurred on every night but one, 21st–22nd, when temp. was 34°. It was freezing on 22 days at 9 a.m. The highest temp. at 9 a.m. was 37°; in 23 years it had not been lower in February than 45°; highest max. 43°; previous lowest max. in February, 48° in 1873.

TORQUAY, CARY GREEN.—Rainfall 2·73 in., and wet days 14, below the average; mean temp. 33°·4, or 9°·0 below the average. Amount of sunshine, 83 h. 55 min., being 1 h. 25 min. above the average; 5 sunless days.

POLAPIT TAMAR.—Exceptionally small rainfall. Except June 1887, this has been the driest month since January 1881, before which date there is no record here. The wind for 25 days was more or less from the E., but there was more than the average amount of sunshine. A very cold month; the mean min. on the grass being 20°·6, and mean min. in the shade, 24°·1.

WOOLSTASTON.—The frost continued with great severity till the 23rd, when there was a partial thaw for two days; the frost then returned, though with less severity than before. Several undoubted readings of the ther. below zero were recorded in the neighbourhood on the 8th. Mean temp. of the month, 28°·3. The mortality amongst the wild birds has been very great.

TENBURY, ORLETON.—The coldest month ever recorded here; the mean temp., 24°·1, being nearly 2°·5 below that of January 1881, and nearly 15°·5 below the average temp. of February. The min. on the 6th, —0°·3 in the screen, and —5°·0 on the grass—is the lowest on record, and the ther. on the grass fell below zero on 4 nights, while on 11 days the temp. did not reach 32°. S and R fell on only two days, and the total fall is, with two exceptions (Sep. 1865 and Feb. 1891), the smallest recorded in any month for 64 years. The rivers were frozen over about the 8th and continued so until the 25th, when the ice broke up. Until the 6th of this month, the lowest temp. recorded here was 0°·0 in screen and —2°·0 on grass, in January 1865.

LEICESTER, BARKBY.—Very cold, as the following min. readings show:—

4th, 4°	7th, —10°	10th, 23°	13th, 0°	16th, 7°
5th, 0°	8th, — 4°	11th, 0°	14th, 10°	17th, 6°
6th, —4°	9th, — 2°	12th, 1°	15th, 23°	—

MANCHESTER, PLYMOUTH GROVE.—Not only the coldest February, but the coldest month experienced since observations commenced 29 years ago. Also the driest month. Mean temp. 29°·5. Fog on six days.

WALES.

HAVERFORDWEST.—The driest February during the last 50 years, and perhaps the coldest. The ice on many ponds varied from 12 to 18 inches in thickness, and on still reaches of the river Cleddau from 10 to 12 inches, while navigation was impeded. On 8 nights the shade temp. fell to between 12° and 20°, and on 14 nights to between 20° and 25°. The only February to compare with it was 1855, when, on the 10th, the shade temp. fell to 8°, and there were 11 nights with the min. ranging from 8° to 20°.

SCOTLAND.

JEDBURGH, SUNNYSIDE.—The temp. of the month was very low, more so than it has been since 1860. There was much sunshine during the day, but the nights were very cold. All outdoor work was suspended; gas and water pipes generally were frozen, and birds suffered much.

COLMONELL.—On 6th and 7th a violent storm of S occurred, lasting for 32 hours, the average depth is estimated at about 2 feet; but the ground was bare in places, and the drifts varied up to 15 feet. Rainfall half the average. Mean temp. 28°·9, 9°·3 below the average. The lowest minimum previously recorded was 6° in 1888.

BRAEMAR.—By far the most severe month on record; the min. being below zero on the following nights:—

7th,	— 1°·5	9th,	—11°·0	11th,	—17°·0	17th,	—9°·0	19th,	—8°·0
8th,	—12°·0	10th,	—14°·0	13th,	— 7°·5	18th,	—7°·5	20th,	—5°·0

GLENCARRON.—S and frost up to the 20th, when a thaw set in.

ROEBERRY.—A very cold month; the coldest recorded; mean temp. 33°·5.

IRELAND.

DARRYNANE ABBEY.—The first few days were very cold with S.E. wind, which backed to S.W. on the 6th, when, about 6 p.m., S began and continued all night, covering the ground to a depth of about 13 inches. On the high grounds and in exposed places the drifts were very heavy, and all postal communication was stopped till the 10th. Wet S and sleet fell on 8th, and R on 10th, 13th and 14th. The rest of the month was very fine but rather cold.

WATERFORD, BROOK LODGE.—A very cold month; prevailing wind easterly. The wind was S. on the 6th when heavy S fell, and the drifts after the blizzard on the 10th had not melted at the close. Thrushes were singing at the close.

O'BRIENSBRIDGE, ROSS—The actual R falling was only ·09 in., the balance of the total being melted snow. Since the memorable year, 1855, there has been nothing to compare with the frost and polar wind of this month, in duration and intensity. S began to fall in the afternoon of 6th and, lasting only two hours, effectually blocked the country for a week after.

DUBLIN.—The coldest February that is since 1855. The mean temp. (34°.2) was 8°·6 below the average, 10°·7 below that of February 1894, and 1°·4 below that of January 1895. There was an overwhelming prevalence of strong E. and S.E. winds. The rainfall was scanty and consisted principally of S and H. Absolute drought held from the 7th to the 20th inclusive. Fogs on six days.

CLIFDEN, KYLEMORE.—On the 9th a snow blizzard raged all day, such as has not been known in the West for many years.

WARINGSTOWN.—Continuous frost, S covering the ground all the month. On the morning of the 7th the min. temp. was —1°, a reading only equalled once since observations began in 1860; though zero was touched on Jan 7th, 1894.

EDENFEL.—The month was remarkable here, as elsewhere, for its intense and protracted severity. Both in January 1867, and in January 1881, even lower temperatures were reached in the screen, but in those years there was no such persistence of low temperature even in January, nor can I find any February record at all approaching that of this year.

NOTICES.

It is requested that all Books for Review, and Communications for the Editor be addressed to him at 62, Camden Square, London, N.W.

The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy,)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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THE FROST — EARTH TEMPERATURES AND WATER PIPES.

WHEN we concluded the article on page 23 of our last number with the words, "Respecting earth temperatures and water pipes we hope to be able to say something next month," we little thought what was before us.

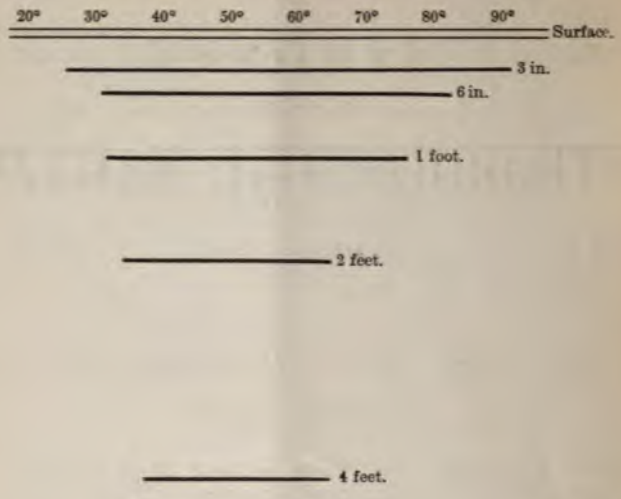
For years past, certainly for more than half a century, there has been a gradually increasing number of stations giving daily records of the temperature of the soil at different depths.

Now that over a large portion of England (not in London only as Londoners seem to imagine), there have been thousands of water pipes burst by the expansion of the contained water in freezing, we hoped that the records of these thermometers would supply ample details. The *Royal Meteorological Society* kindly allowed us to copy the records sent to it, and we have incorporated in some others, but the result is that the records of the thermometers and the facts as to the water pipes seem to be at variance, and to show that the thermometers are wrong—a very disheartening fact (if it is a fact) for those who, like ourselves, have been recording them for a quarter of a century.

Of course, an inference like this must be supported, and should not be mentioned without some reasons being given. And first of all, it may be convenient to inform those who have not previously considered the subject, that the yearly mean temperature of the soil down to say 10 ft. does not vary much, and also that at 10 ft. the difference between the summer and winter is trifling, but the nearer we come to the surface the greater is the influence of season.

From a paper read before the Royal Botanic Society in 1877, and based upon tri-daily observations for six years (1871-76), we take the following facts.

These values are reproduced in the following diagram, which, we trust, is self-explanatory :—



	Absolute Lowest.	Diff.	Mean.	Diff.	Absolute Highest.
	°	°	°	°	°
At a depth of 3 inches ...	26·2	23·5	49·7	43·3	93·0
,, ,, ,, 6 ,, ...	31·0	19·2	50·2	33·8	84·0
,, ,, ,, 1 foot ...	32·0	17·9	49·9	27·3	77·2
,, ,, ,, 2 feet ...	33·0	16·5	49·5	17·8	67·3
,, ,, ,, 4 ,, ...	37·0	13·0	50·0	16·0	66·0

Therefore, these observations, showed no case of a frost penetrating two feet, and only one case of its just reaching one foot.

We may now turn to the figures for 1895, and in the first place we will deal only with records obtained at a depth of one foot, because those observations are the most numerous. We did intend to give the observations *in extenso*, but the following abstract shows so steady a relation between the mean and the absolute minimum, that we see no necessity for printing two pages of figures when the facts can be brought out more prominently by an abstract.

In the table on page 39 we give for February, 1895, the mean temperature at the depth of one foot, and the lowest temperature at that depth at nearly twenty stations.

We have already seen that the deeper the thermometer is buried the less will it feel the frost The following table shows that at 1 foot frost occurred at only 10 stations out of 18, and our previous table and diagram show that the minima are higher for each foot of depth —and, as far as we can see, the logical sequence of this is that the observations show that at no station could frost have occurred at a depth of 2 ft. 6 in.

And this conclusion (we do not say that we believe it), can be sup-

ported by some other records. We are not aware of any observations at the depth of 2ft 6 in., but there are a few at 2 ft. and at 4 ft.

Earth Temperatures at 1 *foot in February*, 1895.

Station.	County.	Mean Temp.	Minimum.	Min. below Mean.
		°	°	°
Lowestoft	Suffolk	29·0	28·2	0·8
Regent's Park, London	Middlesex	30·8	28·2	2·6
Wallington	Surrey	31·9	30·4	1·5
Shaftesbury	Dorset	31·9	30·8	1·1
Bolton	Lancashire	32·2	31·0	1·2
Stowell	Somerset	32·2	31·0	1·2
Camden Square	Middlesex	32·3	30·9	1·4
Harestock, Winchester	Hampshire	32·3	31·7	0·6
Southwell	Notts	32·6	32·0	0·6
Rousdon Observatory	Devon	32·7	31·7	1·0
Bennington	Herts	32·7	32·0	0·7
Norwood	Surrey	32·9	32·1	0·8
Tunbridge Wells	Kent	32·9	31·9	1·0
Rounton	York, N.R.	33·0	32·0	1·0
Hodsock	Notts	33 0	32·2	0·8
Margate	Kent	33·4	32·6	0·8
Somerleyton	Suffolk	33·8	33·0	0·8
Tavistock	Devon	34·0	33·4	0·6

In the above table the stations are grouped in the order of their mean temperature, and some results are remarkable. The coldest station, Lowestoft 29°·0, is within a short walk of the hottest but one, Somerleyton 33°·8. We believe that the thermometers at both stations have been verified, but think that reverification is desirable. There is, however, one important factor respecting underground thermometers, concerning which sufficient precision has not been enforced. We have seen no printed rule as to whether the ground in which they are sunk is or is not to be always open to the sun when it shines. Unfortunately, we did not begin observations on this point ourselves until the frost was nearly over, but we have had two thermometers each 1 foot deep, and within 100 feet horizontally, the one reading 1°·2 above the other. We do not suggest that all or any of the above minima require lowering by 1° 2, we merely say that in winter the sun has enough power, when it shines, to make one patch of ground, at 1 foot below the surface, 1°·2 warmer than another.

There are many other features in the table which need explanation, such as why the absolute minimum at Wallington was nearly 2° below Norwood, and why that at Regent's Park was nearly 3° below Camden Square.

In the following table we give all the minima at 1 ft., 2 ft., and 4 ft., at all stations arranged in our usual sequence, and in the last three columns some figures, to which no further weight must be

attached than this; that according to the information at present available, they represent what appears to have been the temperature at the respective depths, if the several thermometers may be regarded as accurate.

		Observed Minima.			Observed and Estimated Minima at			
		1 ft.	2 ft.	4 ft.	1 ft.	1ft. 6in.	2 ft.	2ft. 6in.
		°	°	°	°	°	°	°
Middlesex.	Camden Sq.	30·9	...	37·1	30·9	32·7	34·1	35·1
,, ...	Roy. Bot. Soc.	28·2	34·0	34·8	28·2	31·0	34·0	33·4
Surrey	Wallington	30·4	...	...	30·4	32·2	33·6	34·6
,,	W. Norwood	32·1	...	...	32·1	33·9	35·3	36·3
Kent	Tunbridge Wells	31·9	...	...	31·9	33·7	35·1	36·1
,,	Margate	32·6	35·8	40·0	32·6	34·4	35·8	37·3
Hampshire	Harestock	31·7	34·2	38·4	31·7	33·4	34·2	35·8
Herts	Bennington	32·0	...	...	32·0	33·8	35·2	36·2
Suffolk ...	Lowestoft	28·2	31·9	36·8	28·2	30·9	31·9	33·3
,,	Somerleyton ...	33·0	...	37·4	33·0	34·8	36·2	37·2
Dorset	Shaftesbury	30·8	...	...	30·8	32·6	34·0	35·0
Devon	Tavistock	33·4	...	...	33·4	35·2	36·6	37·6
,,	Rousdon	31·7	35·5	38·1?	31·7	33·8	35·5	36·2
Somerset ..	Stowell	31·0	...	...	31·0	32·8	34·2	35·2
Notts	Southwell	32·0	...	...	32·0	33·8	35·2	36·2
,,	Hodsock	32·2	...	...	32·2	34·0	35·4	36·4
Lancashire	Bolton	31·0	33·2	35·6	31·0	31·9	33·2	34·3
,, ...	Blackpool	...	...	36·8	30·5	32·3	33·7	34·7
York N.R.	Rounton	32·0	...	...	32·0	33·8	35·2	36·2

From this we see that, according to the thermometers,—

Frost penetrated to 1 ft. at 11 stations.
,, ,, 1ft. 6in. 3 ,,
,, ,, 2ft. 1 station.
,, ,, 2ft. 6in. no station.

The fact that ice formed in many pipes buried 2ft. 6ins. is, we believe, indisputable, indeed, we have statements of its being found at depths exceeding 3 ft., but space will not allow us to enter into details this month, nor to point out what may be the explanation of the apparent discordance.

Erratum.—Mr. von V. Searle has pointed out that the table at the top of p. 22 is not complete; we were aware of it when we wrote "The following are minima," instead of writing "The following are *all the* minima," but had forgotten it when we wrote the concluding words of the sentence. We do not think that lower readings are omitted, but that in some years there were other days with min. below 10°—this is certainly the case with Jan. 7th, 1841, on which it fell to 9°·8; and on Jan. 4th, 1867, when it fell to 7°·7; therefore, in each of those years, as in 1895, there were two consecutive days with minima below 10°.

THE GREAT GALE IN THE MIDLANDS ON MARCH 24TH.

THERE can be no question as to this having been locally, one of the heaviest gales for many years. We have not space to report fully, but reproduce two typical descriptions, and a few others will be found in the "Notes on the Month" on p. 51.

To the Editor of the Meteorological Magazine.

SIR,—On Sunday, March 24th, at 9 a.m., the wind was S.S.W., force 5; then it increased, and must have been blowing 6, 7, or perhaps 8 towards noon, with small showers, and a smart one about 0.30 p.m. At 1 p.m. the wind was about force 8 from S.W., but it was not till 1.30 p.m. that I became alarmed. Direction was then W.S.W., and sky quite as much blue as cloudy. The wind was so furious, with distinct blasts of greater force, that I went to a window which commands a view of the main gable of the house, where slates had gone in the gale of February 11th, 1894. It was clear that they would go again. They trembled and shivered; one edge-slate slipped down, was caught by the wind, hurled over the house, and smashed on a door-step on the other side. One by one others went away, and at 2 so many were flapping and quivering that I had great fears for the roof itself. At 2.10 damage to the slates ceased, *not* by a change in the direction of the wind, but by abatement of its force. Meantime the cross above the weathercock on the church spire (copper, and 2 feet long) had been torn away by the wind, and the rod of the weathercock was shaking terribly. Some said they saw the stone-work of the spire move. This *I* could *not* see, nor can I see any sign of cracking since.

When it was safe to go out, I found that the village street was full of thatch. Every house with thatch was showing a hole somewhere. Chimney-pots, ridge-tiles, and slates had gone more or less from every house; but the destruction to the trees was the worst. Just outside my garden five large elms were lying side by side, torn up by the roots. This I fancy was done by one blast between 1.50 and 2, for exactly in the direction towards which these pointed, which was a few yards to the south of my vicarage, three solid chimney-pots had been carried away from a very substantial farmhouse, and, still in the same straight line, close to another farmhouse, seven large trees lay together (poplars, a Scotch fir, a larch, and a kind of ash), and further on, still in the same line, lay two large elms, torn up by the roots also. I have counted 19 large trees down within a very short half-mile of my house, not counting broken limbs of trees, and I am by no means sure that I have seen all.

The damage to thatch, tiles, &c., may supply a good measure of the force of the wind as compared with that of other gales; but the tearing up of the trees I judge to be due in great part to the late frost. The seven great elms torn up by the roots, already mentioned, were in low-lying hollows, where frost had gone deepest, and where

the ground has since been unusually loose for about two feet from the surface. On higher ground the roots had held for the most part (not always), and the tree stems had snapped near the ground, or some way up.

But whether to trees or to buildings, no gale since I have been here has done damage in any way comparable to this, and no one pretends to remember anything approaching to it. I wish I had had any means of calculating the angle to which a fir tree opposite my study window bent without breaking!

By 3 p.m. the wind had much abated; by 4 it had ceased to be at all remarkable, and by sunset was not more than a fresh breeze. There was much lightning about 8 p.m. in N.W.

The hurricane may be said to have lasted from 1.30 to 2.15, and the very worst of it from 1.50 to 2. The extreme force might certainly be put as high as 11, perhaps even at 12. Had the extreme fury continued for an hour, there is no knowing how the house roofs would have stayed on.—Yours very truly,

H. A. BOYS.

Easton Mauduit Vicarage, Northampton.

To the Editor of the Meteorological Magazine.

SIR,—The comparatively scanty accounts in the London papers of Sunday's storm lead me to suppose that the intensity in the metropolis was very much inferior to that experienced in this county, where it is stated that, as far as the disastrous results are concerned, nothing like it has been experienced since 1703.

I well remember the great gale of the 14th of October, 1881, and the numbers of trees which were then blown down, but it was *not to be compared* with that of the 24th of March, 1895. Older men than myself speak of the great "May" gale of 1860, with which they compare the recent one, but all admit that even that did not equal the awful and destructive hurricane we have just passed through.

My own experiences of Sunday were as follows. After a stormy night, with rain, at 9 a.m. the wind was blowing a moderate gale from W.S.W., the sky was clouded, the barometer (corrected and reduced). was 29·28 ins. Temp. dry, 51°·6; wet, 51°·0. The min. had been as high as 47°·8. During the forenoon the wind slightly increased and the sky partially cleared. At 2 p.m. the barometer had fallen to 29·09 ins., and the wind was blowing a fresh gale nearly due W. At 3 p.m. the hurricane began in earnest, and a few minutes later my garden wall was blown over. At 3.30 p.m. the gale was at its height, the barometer being 28·99 ins. The gusts were something terrific. The water was being blown out of the river like dense clouds of smoke over the adjoining marshes, and the spray could be felt in my garden, 60 feet above it. Rockland and Surlingham Broads were compared to "bonfires," so great and dense were

the clouds of spray being blown out of them. Three signal posts on the line were blown down, and roofs were swept of tiles by the 100, chimney-pots blown down, and in many instances stacks of chimneys blown through the roofs. At Blofield Church the service was suspended, the lead on the roof was rolled up like parchment, many of the trees in the churchyard were uprooted, and the congregation was unable to leave by the usual door owing to the falling masonry. At Strumpshaw (the adjoining parish) a whole plantation of larch trees was laid flat, not a tree left standing, and the grounds of Brundall House, noted for the great variety of beautiful trees and shrubs were left a perfect wreck, large trees being piled one on the top of another. On a farm near here 300 trees were blown down and in a park near East Dereham it is said that 1100 trees were uprooted. In some parts of Norwich the houses look as if they had been bombarded, the roofs being stripped of tiles, chimney stacks fallen through the roofs, and windows blown in. Nothing the least approaching it has happened in my recollection, nor of anyone, even of old people with whom I have come in contact.

After 3.30 p.m. the barometer rose briskly, and from 4 p.m. the gale gradually abated. At 9 p.m. the barometer had risen to 29·34 ins., the wind was W.N.W., about force 6, and there was much distant lightning.

I see that in the *Quarterly Journal Roy. Met. Soc.*, 1874 (p. 111), it is stated that a "hurricane that tears up trees and throws down buildings" has a velocity of 110·48 miles per hour. I should think, therefore, that the most violent gusts on Sunday afternoon must have been but little short of force 12.

Yours very truly,

ARTHUR W. PRESTON.

Bradestone House, Brundall, Norwich, 26th March, 1895.

P.S.—I have since ascertained that the damage caused in Norfolk by the gale of the 24th ult. is far more extensive than I was then aware of. On three estates I hear of 2,000 trees being blown down, and on another of 1,700.

I have recently been in Suffolk, where they also experienced a severe gale, but the results appear trifling when compared with the devastation wrought in this county.

To the Editor of the Meteorological Magazine.

SIR,—A severe S.W. gale, apparently at its height from noon till 1 p.m., as during that time 10 great forest trees were blown down to my knowledge (principally elm) within a mile of here, and various other damage was done. Rainfall only ·03 in.; lightning at night.

ROSE E. STANTON.

Upfield, near Stroud, Gloucestershire, March 24th, 1895.

SNOW FROM A CLOUDLESS SKY.

To the Editor of the Meteorological Magazine.

SIR,—The 6th of February was a brilliant day here, but at intervals some snow crystals and minute spiculæ of ice fell without any visible cloud, and unaccompanied by any other form of snow.

These corresponded, for the most part, with Figs. 89, 98, 104 and 132 in the series of snow crystals published in the Fifth Annual Report of the Roy. Met. Soc.

Snow crystals also fell on February 1st, 2nd, 7th, 8th, 14th and 15th, in endless variety of forms.

Yours truly,

C. LEESON PRINCE.

The Observatory, Crowborough, Sussex, March 29th, 1895.

REVIEWS.

Meteorological Work in Australia: A Review, by Sir C. TODD, K.C.M.G., F.R.S. [? "Excerpt Report Australian Association for the Advancement of Science.] 8vo, 25 pages, 1 plate.

AT the first meeting of the Association at Sydney, in 1888, Mr. Russell epitomized the work in Astronomy and Meteorology done in Australia up to 1860; in the present paper Sir Charles Todd deals with the period from 1860 to 1892. Incidentally, he gives some figures so startling and so important that we at once proceed to extract them. We must, however, first explain where "Alice Springs" is, because some of our readers may not know.

Sir Charles Todd was appointed Government Astronomer of South Australia in 1856, and with that appointment was joined that of Director of the Telegraph service. Towards the end of the sixties, the wonderful undertaking of erecting a line of telegraph right across Australia from South to North (about 2,000 miles) was commenced, and finished in 1872 by Sir Charles; and Alice Springs is the name of a telegraph station not many miles from the centre of the vast continent of Australia.

We will now let Sir Charles tell his own tale:—

"At Alice Springs there is a large evaporation tank similar to that at the Adelaide observatory, which it may be convenient here to describe. It consists, first, of a brick tank lined with cement; internal measurement, 4 ft. 6 in. square and 3 ft. 2 in. deep. Inside this tank is another, made of slate, 3 ft. square and 3 ft. deep, leaving an intervening space between it and the larger tank of 7 in. Both tanks are filled to the same level, or to within 3 in. or 4 in. of the top, fresh water being added as required. The evaporation is measured by a graduated vertical rod, which is carried by a float placed in a vertical cylinder of copper 4 in. in diameter (perforated at the bottom) standing in the inner tank. The rod is graduated to $\frac{1}{10}$th of an inch, and is read off by means of a fixed vernier to $\frac{1}{100}$th

of an inch. A rain gauge is placed by the side of the tank, and both the evaporation and the rainfall are read at 9 a.m. and 9 p.m.

"As the question of evaporation is an important one in connection with water conservation, I give below the mean evaporation at Adelaide, deduced from twenty-three years' observations, and at Alice Springs, in the centre of the continent, during the years 1890, 1891 and 1892.

Evaporation at Adelaide.		Evaporation at Alice Springs.		
Mean of Twenty-Three Years.		1890.	1891.	1892.
	Inches.	Inches.	Inches.	Inches.
January	8·93	—	12·84	14·02
Febuary	7·23	11·20*	13·84	10·55
March	6·03	11·99	11·85	8·72
April	3·60	6·00	5·04	7·18
May	2·13	4·76	4·48	4·66
June	1·38	3·15	2·66	3·95
July	1·46	4·44	3·82	4·21
August	2·03	5·43	5·81	5·69
September	3·02	—	7 78	8·17
October	4·86	11·22	8·23	9·84
November	6·50	11·73	9·26	11·87
December	8·36	13·79	12·94	11·49
Year	55·53	—	98·55	100·35

* Twenty-seven days.

Greatest [evaporation] in one year at Adelaide ... 60·95 in. in 1876.
Least [evaporation] in one year at Adelaide ..... 47·39 in. in 1892.
Average rainfall at Adelaide for 54 years ..... 21·08 in.
Average rainfall at Alice Springs for 19 years..... 11·25 in.

We have heard that when fixing the telegraph there was one station (and we rather think that it was Alice Springs) to which drinking water had to be sent several hundred miles. With the supply which its present name indicates, and with a mean rainfall of 11¼ inches, it is now, doubtless, independent, but it will need something to keep up an evaporation of 100 inches a year.

Bodenphysikalische und Meteorologische Beobachtungen mit besonderer berücksichtigung des Nachtfrostphänomens, von THEODOR HOMEN, Privatdocent an der Universität zu Helsingfors. Mayer and Müller, Berlin, 1894, 225 pages and two plates.

WE have never seen a satisfactory explanation of the reason why persons who write in German do their work with such thoroughness. We have here a book written by a member of the University of Helsingfors (just where the Baltic narrows to become the Gulf of Finland), which is in many respects a model. Twelve years ago he wrote a short paper on nocturnal frosts; and in the pre-

sent book he carries on the investigation with fresh instruments, and in relation, not merely to night frosts, but to dew and to evaporation. The work seems to us to have only one failing, and that is one rather usual with German books—an absence of wood-cuts. A sketch of one or two of his thermometers in position, a process-photo of one of his experimental groups, and an outline plan showing the sites of the observations, would have made it more easy to appreciate fully the conditions of the experiments.

The author explains the pattern of the thermometer used, and the precautions taken to ensure accuracy. He had about thirty-six thermometers, thirty of which were in groups of six each. Each group had its bulb at the respective depths below the surface of—

0 ¾ in. 2 in. 4 in. 8 in. 1 ft. 4 in.

and the five groups were respectively placed in—

(1) Open sandy heath, with scanty grass.
(2) Sandy heath, but very shady, with small pine trees.
(3) Loamy soil, bearing wheat.
(4) On an open moor or bog.
(5) On a field of rye reclaimed from the moor or bog.
(6) In a fir plantation on the same moor or bog.

Three observers took part in the work, and the whole thirty thermometers were read hourly from 11 a.m. on August 12th, 1892, till 4 p.m. on the 14th, *i.e.*, for 53 consecutive hours, and from 4 a.m. September 6th, 1892, to midnight, September 8th-9th, *i.e.*, for 68 hours. These observations are printed *in extenso*.

We notice one erroneous entry; whether a mistake in the observation or a misprint, we cannot tell, but certainly the reading of the 5 cm. thermometer at 3 p.m. on August 14th was 16°·0 not 15°·0; otherwise the tables are remarkably accurate.

We cannot, of course, quote the figures *in extenso*, but roughly the results for August 12th to 14th are :—

	Daily Range of Temperature.	
	Open Heath.	Fir Plantation on a Moor or Bog.
Surface.....	27°·5 F.	12°·5 F.
¾ in. below	18·0	6·5
2 in. ,, ...	13·0	3·0
4 in. ,, ...	8·5	1·0
8 in. ,, ...	5·0	0·5
16 in. ,, ...	1·1	0·0

In subsequent sections, the author deals with the capacity of the various strata of the soil for heat, the temperature exchanges between the soil and the atmosphere, and the amount of water found in the various layers of earth.

He then deals with the amount of dew and its mode of production, giving notes from Aristotle, Gersten, Six, Wilson, Wells, Fusinieri, Stockbridge, Chistoni, Aitken, Wollny, Russell, Masure, Marié-Davy, Flauguergues, Raddi, Nacca, Gasparin and Dines, and

finishing up with original experiments by himself with various flannels and other woven materials.

The next section is the weakest in the book. It is devoted to evaporation, and is almost wholly based upon records with Dr. Wild's apparatus, the important work done by French engineers, and copied in this country, in America, and Australia, being apparently unknown to Professor Homén.

The last sections are devoted to explaining the production of night frosts and their prediction.

No one ought to write on the above subjects until he has made himself familiar with what the author has done.

An Essay on Southerly Bursters by H. A. HUNT, Second Meteorological Assistant, Sydney Observatory. [Excerpt Journal Royal Soc. of N. S. Wales.] 8vo, 48 pages, four photo plates.

[*Awarded the Prize of £25 offered by the Hon Ralph Abercromby, for the best Essay on Southerly Bursters, May 2nd*, 1894.]

MR. ABERCROMBY is to be congratulated on this the first outcome of his donation to the Royal Society of New South Wales. The writer is evidently more at home in weather forecasting, and in the study of synchronous observations, than in literary work, but as he says (although had he been a more practised scribe he would have left it to others to say), he has devoted "a vast amount of patient research," and the result is, we think, very satisfactory.

We do not like the name "Southerly Burster" so well as its precursor, "Brickfielder," and Mr. Hunt's reason for the change seems to us rather insufficient; however, he ought to know if anyone does, and this is his statement:—

"In the early days of Australian settlement, when the shores of Port Jackson were occupied by a sparse population, and the region beyond was unknown wilderness and desolation, a great part of the Haymarket was occupied by the brickfields, from which Brickfield Hill takes its name. When a 'Southerly Burster' struck the infant city, its approach was always heralded by a cloud of reddish dust from this locality, and, in consequence, the phenomenon gained the local name of a 'brickfielder.' The brickfields have long vanished, and with them the name to which they gave rise, but the wind continues to raise clouds of dust as of old, under its modern name of 'Southerly Burster.'"

The essay contains a mass of information generally well arranged, and will, we think, remain for some time the best paper upon the subject.

The investigation of the Helm Wind by the Royal Meteorological Society left upon our mind the impression that its importance had been considerably exaggerated, but Mr. Hunt's paper, and especially plates v., vi. and viii., have reminded us of it, for the plates represent rolls of cloud similar to those which we understood prevailed during a Helm Wind, and formed the Helm and the Helm Bar.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	71·2	1	36·7	28	63·0	48·0	48·1	79	113·6	31·6	1·05	11	6·6
Malta	95·8	5*a*	65·0	23	87·3	71·6	68·4	76	145·7	60·4	·23	1	2·1
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	79·0	25	61·4	5	76·5	64·7	61·1	75	129·4	52·3	1·88	16	5·7
Calcutta	90·6	22	75·8	21	87·6	77·8	78·6	89	158·7	74·3	6·52	15	7·2
Bombay	86·2	4	73·3	22	83·1	75·7	74·9	86	139·3	71·5	12·04	25	8·4
Ceylon, Colombo	87·6	21	69·6	6	85·6	76·7	72·5	80	148·5	68·0	·78	15	7·5
Melbourne	71·2	20	36·1	29	60·5	43·6	43·7	74	124·9	30·0	2·69	19	5·5
Adelaide	77·0	20	37·2	6	64·3	45·5	44·9	72	140·6	31·8	1·02	16	4·5
Sydney	79·8	22	45·3	18	64·1	49·9	49·0	76	135·8	32·5	4·62	22	5·4
Wellington	64·0	8	36·0	3,16	56·6	45·2	42·1	73	125·0	23·0	5·03	19	4·8
Auckland	69·0	11	35·0	3	59·9	48·1	47·3	77	130·0	31·0	5·08	21	6·4
Jamaica, Kingston	92·9	21	70·6	19	90·1	73·8	71·8	77	...	...	1·55	6	4·4
Grenada	87·2	12	69·8	29	84·1	74·9	72·8	77	155·0	...	12·16	26	4·9
Trinidad	91·0	*c*	69·0	26	89·1	71·4	71·5	81	172·0	67·0	5·48	12	...
Toronto	84·1	2	38·9	26	71·5	53·7	54·7	78	...	30·0	5·48	14	5·1
New Brunswick, Fredericton	77·7	22	29·5	27	67·2	46·4	48·3	72	...	...	2·60	8	6·1
Manitoba, Winnipeg	85·0	5	26·8	17	65·8	42·3	...	...	...	...	2·18	11	5·7
British Columbia, Esquimalt	68·0	10	40·2	23	60·2	47·6	50·4	89	...	...	3·73	17	6·2

a—and 14. *b*—and 19. *c*—Various.

REMARKS.

MALTA.—Adopted mean temp. 77°·6, 3°·0 above the average. Mean hourly velocity of wind 8·2 miles. Thunder storm on 30th. Lightning on 18th and 19th. No rain, except a few drops on 18th, before the night of 30th. September, 1893, was the first rainless September recorded in 12 years. J. F. DIBSON.

Mauritius.—Mean temp. of air equal to, dew point 1°·3 above, and rainfall ·42 in. above, their respective averages. Mean hourly velocity of wind 11·1 miles or 0·9 below average; extremes 25·3 on 1st, and 1·6 on 6th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

Adelaide.—Mean temp. 2°·2 below the average of 37 years. Rain ·80 in. below the average. C. TODD, F.R.S.

Sydney.—Mean temp. 1°·7 below, humidity 6°·1 above, and rainfall 1·41 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington. On the whole a showery month, with occasional intervals of fine weather; prevailing southerly weather and strong wind from that quarter from the 1st to 3rd and 19th and 20th. Thunder hail and snow on 2nd; fog on 8th. Mean temp. same as average; rainfall ·77 in. above average. R. B. GORE.

Auckland.—A wet, stormy and disagreeable month. Slight snow storm on the 3rd, the first snow recorded in Auckland for fifteen years. Rainfall about 1·50 in. in excess. Barometric pressure and mean temperature both considerably below the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Cyclone to the North on 23rd. Mean hourly velocity of wind 3·8 miles; prevailing direction S.S.E. Island rainfall a little less than, and Kingston rainfall one-third of, their respective averages. R. JOHNSTONE.

TRINIDAD.—Rainfall 2·05 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·20	XI.	Lake Vyrnwy	4·67
,,	Birchington, Thor	1·11	,,	Corwen, Rhug	1·52
,,	Hailsham	2·45	,,	Carnarvon, Cocksidia ...	4·71
,,	Ryde, Thornbrough	2 07	,,	I. of Man, Douglas	4·43
,,	Emsworth, Redlands ...	2·13	XII.	Stoneykirk, Ardwell Ho.	3·88
,,	Alton, Ashdell.....	1·96	,,	New Galloway, Glenlee	4·35
III.	Oxford, Magdalen Col...	1·34	,,	Melrose, Abbey Gate	3·71
,,	Banbury, Bloxham	2·53	XIII.	N. Esk Res. [Penicuick]	5 40
,,	Northampton, Sedgebrook	2·28	,,	Edinburgh, Blacket Pl..	2·80
,,	Alconbury	1·54	XIV.	Glasgow, Queen's Park.	1·17
,,	Wisbech, Bank House..	2·01	XV.	Inverary, Newtown	6·25
IV.	Southend	1·24	,,	Islay, Gruinart School..	1·15
,,	Harlow, Sheering	1·18	XVI.	Dollar.....	4·57
,,	Colchester, Lexden.....	1·21	,,	Balquhidder, Stronvar.	5 01
,,	Rendlesham Hall	1·78	,,	Balliuluig	1·47
,,	Diss	1·79	,,	Dalnaspidal H.R.S. ...	4·87
,,	Swaffham	2·32	XVII.	Keith H.R.S.	3 95
V.	Salisbury, Alderbury ...	1·74	,,	Forres H.R.S.	2·74
,,	Bishop's Cannings	2·67	XVIII.	Fearn, Lower Pitkerrie.	1·42
,,	Blandford, Whatcombe.	2·81	,,	Loch Shiel, Glenaladale	7·75
,,	Ashburton, Holne Vic....	4·04	,,	N. Uist. Loch Maddy ...	2·38
,,	Okehampton, Oaklands.	3·28	,,	Invergarry	5·23
,,	Hartland Abbey	3·03	,,	Aviemore H.R.S.	3·05
,,	Lynmouth, Glenthorne.	4·07	,,	Loch Ness, Drumnadrochit	7·20
,,	Probus, Lamellyn	3·30	XIX.	Invershin	2·18
,,	Wellington, Sunnyside..	3·05	,,	Scourie	3·98
,,	Wincanton, Stowell Rec.	2·68	,,	Watten H.R.S.	1·97
VI.	Clifton, Pembroke Road	2·27	XX.	Dunmanway, Coolkelure	7·48
,,	Ross The Graig	2·13	,,	Fermoy, Gas Works ...	2·42
,,	Wem, Clive Vicarage ...	2·17	,,	Killarney, Woodlawn ...	5·10
,,	Cheadle, The Heath Ho.	2·49	,,	Caher, Duneske	3·82
,,	Worcester, Diglis Lock	1·62	,,	Ballingarry, Hazelfort...	2·61
,,	Coventry, Coundon	2·19	,,	Limerick, Kilcornan ...	2·93
VII.	Ketton Hall [Stamford]	1·81	,,	Ennis	2·76
,,	Grantham, Stainby	2·37	,,	Miltown Malbay.....	4·16
,,	Horncastle, Bucknall ...	2·10	XXI.	Gorey, Courtown House	2·86
,,	Worksop, Hodsck Priory	1·52	,,	Athlone, Twyford	3·55
VIII.	Neston, Hinderton	2·56	,,	Mullingar, Belvedere ...	3·41
,,	Preston, Haighton	3·29	,,	Longford, Currygrane...	3·67
,,	Broughton-in-Furness..	6·21	XXII.	Woodlawn.....	4·22
IX.	Ripon, Mickley	2·64	,,	Crossmolina, Enniscoe..	5·04
,,	Melmerly, Baldersby ...	2·17	,,	Collooney, Markree Obs.	4·04
,,	Scarborough, South Cliff	1·57	,,	Ballinamore, Lawderdale	4·11
,,	Middleton, Mickleton..	3·53	XXIII.	Lough Sheelin, Arley ..	3·36
X.	Haltwhistle, Unthank..	3·41	,,	Warrenpoint	3·84
,,	Bamburgh.....	2·42	,,	Seaforde	3·01
,,	Keswick, The Beeches...	5·28	,,	Belfast, Springfield	4·24
XI.	Llanfrechfa Grange	4·20	,,	Bushmills, Dundarave...	3·59
,,	Llandovery	5·40	,,	Stewartstown	3·49
,,	Castle Malgwyn	4·56	,,	Buncrana	4·00
,,	Builth, Abergwessin Vic.	8·52	,,	LoughSwilly, Carrablagh	3·91
,,	Rhayader, Nantgwillt..	5·67			

MARCH, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Max. Date	Min. Deg.	Min. Da
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	1·42	— ·19	·38	26	14	63·7	22	23·7	
II.		Maidstone (Hunton Court)...	1·52	+ ·02	·26	9	19	...	...	...	
,,		Strathfield Turgiss	1·44	— ·15	·43	25	19	66·0	22	22·8	1
III.		Hitchin	1·94	+ ·60	·59	27	14	60·0	21	24·0	
,,		Winslow (Addington)	1·56	— ·16	·29	26	16	61·0	22	19·0	
IV.		Bury St. Edmunds (Westley)	1·93	+ ·38	·32	27	15	57·0	21*b*	25·0	
,,		Norwich (Brundall)	1·86	...	·28	3	19	6 ·2	23	23·0	
V.		Weymouth(LangtonHerring)	2·33	+ ·43	·43	26	19	55·0	20*b*	23·0	
,,		Torquay (Cary Green)	3·11	...	·60	26	15	61·9	20	29·4	
,,		Polapit Tamar [Launceston]..	3·03	+ ·50	·50	26	16	62·5	22	27·0	1
VI.		Stroud (Upfield)	2·37	+ ·18	·39	27	21	61·0	21	26·0	
,,		ChurchStretton(Woolstaston)	1·99	— ·14	·25	28	18	61·0	22	22·0	
,,		Tenbury (Orleton)	1·74	— ·34	·26	26	16	63·5	21*b*	20·8	
VII.		Leicester (Barkby)	1·67	— ·04	·39	30	18	61·0	23	20·0	2,
,,		Boston	1·96	+ ·42	·32	9	15	65·0	17	25·0	
,,		Hesley Hall [Tickhill].....	1·50	— ·40	·37	9	13	62·0	18	25·0	
VIII.		Manchester(PlymouthGrove)	2·93	+ ·71	46	23*a*	20	57·0	18	25·0	
IX.		Wetherby (Ribston Hall) ..	1·00	— 1·06	·35	10	9	...	...	...	
,,		Skipton (Arncliffe)	4·93	— ·17	1·09	23	23	...	...	...	
,,		Hull (PearsonPark)	1·68	— ·37	·30	24	19	60·0	17*b*	24·0	
X.		Newcastle (Town Moor)	2·22	— ·41	·46	9	17	...	...	...	
,,		Borrowdale (Seathwaite).....	13·39	+ 2·89	4·41	23	26	...	...	...	
XI.	WALES.	Cardiff (Ely).....	4·65	+ 1·67	1·01	27	17	...	...	...	
,,		Haverfordwest	4·33	+ 1·09	·93	23	25	57·8	17	27·8	1
,,		Aberystwith (Gogerddan) ...	5·16	+ 2·18	·81	23	18	55·0	25	21·0	
,,		Llandudno.....	3·47	+ 1·39	·47	24	21	...	...	...	
XII.	SCOTLAND.	Cargen [Dumfries]	3·22	— ·08	·68	23	13	57·8	21	25·8	
,,		Jedburgh (Sunnyside).....	...	...	...	...	...	...	...	...	
XIV.		Colmonell	4·16	...	·73	8	20	59·0	22	25·0	
XV.		Lochgilphead (Kilmory)	4·42	— ·04	·74	23	20	...	...	21·0	2,
,,		Mull (Quinish).....	4·25	+ ·41	·86	24	16	...	...	...	
XVI.		Loch Leven Sluices	3·60	+ ·63	·80	28	12	...	...	...	
,,		Dundee (Eastern Necropolis)	2·30	— ·10	·85	27	17	58·9	21	25·0	
XVII.		Braemar	2·29	— ·35	·77	28	16	49·2	21	13·8	1
,,		Aberdeen (Cranford)	4·04	...	1·07	28	21	58·0	16*c*	24·0	
XVIII.		Strathconan [Beauly]	4·22	— ·10	1·00	29	9	...	...	...	
,,		Glencarron Lodge.....	8·91	...	1·04	23	26	52·8	22	18·0	
,,		Cawdor [Nairn]	4·18	+ 2·14	1·21	28	21	...	...	...	
XIX.		Dunrobin	2·92	+ ·67	·45	28	22	55·5	16	30·0	
,,		S. Ronaldsay (Roeberry).....	1·85	— ·69	·24	20	26	50·0	16	22·0	
XX.	IRELAND.	Darrynane Abbey.....	4·47	...	·93	23	22	...	...	...	
,,		Waterford (Brook Lodge) ...	3·33	+ ·43	·84	23	14	60·0	21	27·0	5,
,,		O'Briensbridge (Ross)	4·33	...	·84	23	18	...	...	...	
XXI.		Carlow (Browne's Hill)	3·48	+ 1·11	·57	24	18	...	...	...	
,,		Dublin (FitzWilliam Square)	2·75	+ ·74	·57	27	19	58·7	16	29·5	1
XXII.		Ballinasloe	3·27	+ ·64	·64	27	19	57·0	16	24·0	
,,		Clifden (Kylemore)	9·65	...	1·70	7	21	...	...	...	
XXIII		Waringstown	3·34	+ ·99	1·10	27	21	60·0	17*b*	25·0	
,,		Londonderry (Creggan Res.).	3·61	+ ·88	·65	20	27	...	...	...	
,,		Omagh (Edenfel)	3·50	+ ·99	·49	27	26	54·0	23	25·0	

a And 24. *b* And 22. *c* And 21. *d* And 12, 13. *e* And 13.

+*Shows that the fall was above the average*; —*that it was below it.*

METEOROLOGICAL NOTES ON MARCH, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—March opened with changeable weather, with showers of sleet and S, and with a low mean temp. Towards the middle of the month the weather became more genial, but the end of the month was very unsettled, with heavy gales of wind. Snowdrop in flower on 1st, palm blossom on 7th, daisy in flower on 16th, humble bee first seen on 22nd.

ADDINGTON.—The first fortnight cold, afterwards milder and a few fine days. From the 24th until the end the bar. was very low, and a heavy gale occurred on the 24th, its greatest violence being between 1 p.m. and 2 p.m. A great deal of damage was done—many trees uprooted, and others wrenched in two at heights ranging from three to 15 feet from the ground, much injury also to buildings and stacks.

BURY ST. EDMUNDS.—A favourable month generally, with little east wind. Remarkable for the very severe gale of Sunday, the 24th. The wind had been rough all the morning, but began to blow violently about 2 p.m., and continued tremendous till 3.30 p.m., when it gradually subsided. The greatest force of the gale was about 2.55 p.m. The corn stacks had the tops blown off, and sheaves of corn were carried a great distance; straw stacks suffered much, and slates and tiles went in all directions; many fine trees had their tops blown off. A remarkable cloud of a yellow red colour, which appeared to be at least 10 miles in length, was formed in the North by the sand blowing off the light lands. I consider this the heaviest gale in Suffolk since 1857, when I first reported to you. S on 2nd, 3rd, and 4th.

NORWICH, BRUNDALL.—The fine weather of the middle fortnight brought up the month's mean temp. to slightly above the average. The devastating hurricane on the afternoon of the 24th—the most severe on record in these parts—will make the month a memorable one. S daily from 1st to 5th.

LANGTON HERRING.—The mean temp. at 9 a.m. 40°·8 is 0°·7 below the average of 24 years. The dense fogs on the 22nd, 23rd and 24th were the most notable feature of the month; fogs occurred also on the 9th, 15th, and 27th. L on the night of the 23rd. A very high wind on the 24th, which, however, did no damage in this neighbourhood. Solar halo on the 11th.

TORQUAY, CARY GREEN.—Rainfall ·12 in. above the average; wet days exactly the average. Mean temp. 43°·8 or 1°·2 above the average. Amount of sunshine 151 hours 20 minutes, being 2 hours above the average; three sunless days.

POLAPIT TAMAR.—Rather wetter than March usually is, and an absence of the characteristic bleak east wind that usually prevails. S on 3rd.

STROUD, UPFIELD.—About half an inch of S on the ground on 2nd, and S showers on 3rd and 4th. Aurora seen at 8.30 p.m. on 13th. S.W. gale on 24th, greatest force apparently from noon to 1 p m.; many forest trees blown down; S.W. gale also on 28th.

WOOLSTASTON.—The early part of the month was cold, with frost nearly every night, and S fell on the 2nd. The last fortnight was more genial. A heavy gale raged on the 24th, which became a terrific hurricane about 1 p.m., uprooting trees, levelling stacks, and blowing down chimneys in all directions, in the course of about 10 minutes. Severe storms of H occurred the same evening. Mean temp. 41°·7.

TENBURY, ORLETON.—A fairly favourable month; cold and dry till the 19th, then much warmer with frequent R to the end. Great gale on 24th, doing an immense amount of damage, and L at night. S on 2nd and 3rd. The temp. reached 50° on 11th, for the first time since December 26th.

LEICESTER, BARKBY.—A cold and wet month, except for a few days in the middle. Fearful hurricane, doing much injury, with R, L and T, for nearly three hours on 24th. Mean temp. 41°·2.

HESLEY HALL.—Heavy gale, with T, L and H on 24th. Frost on 11 out of the first 17 days; none after.

MANCHESTER, PLYMOUTH GROVE.—S on 3rd, and S and sleet on 5th. Dense fog on 18th; thick fog and wet mist on the 7th. Very stormy weather on 24th and 25th, with T and L.

WALES.

HAVERFORDWEST.—A fall of S on the 3rd, covering the ground, was followed by a couple of days' hard frost; continuous R then set in until the 15th, but although R fell on 25 days or nights, yet there were a great many hours of bright sunshine and fine weather; these factors, taken together with the sharp night frosts, combined to bring the land into a favourable condition for ploughing and sowing. The weather became unsettled, cold and stormy from the 18th, and in the night of the 23rd a strong gale arose, and a terrific squall at 11 a.m. on 24th in a few minutes unroofed houses, and blew down trees, and nearly took several persons off their feet. Squally wintry weather continued to the end of the month.

GOGERDDAN.—Very stormy and cold throughout the month, with very little sunshine.

SCOTLAND.

CARGEN.—A dull, sunless month. Duration of sunshine only 82 hours, the average for 36 years being 128 hours. The mean bar. reading also is exceptionally low, 1861 and 1876 being the only years with a lower mean for March. The changes of both temp. and pressure were great and sudden. Owing to the long continued frost which lasted almost uninterruptedly for ten weeks from December 29th, 1894, to March 9th, 1895, vegetation is unusually backward.

COLMONELL.—Rainfall ·96 in. above the average.

ROEBERRY.—Mean temp. 39°·6.

IRELAND.

DARRYNANE ABBEY.—On the whole a wet but mild month, with some very fine, warm days in the middle.

WATERFORD, BROOK LODGE.—Mean temp. 44°·3. T on 25th and 30th. H on 24th and 30th. The Comeragh, Carlow and Wexford mountains were covered with new S on the 3rd.

O'BRIENSBRIDGE, ROSS.—More than average R for March, with very cold and wintry weather, especially at the close of the month. Great storm on 24th and 25th, with much L and T. Vegetation late.

DUBLIN.—A changeable, dull and rather rainy month. The cold weather which had prevailed through January and February lasted until the 13th, when the ther. touched 50° in the shade, for the first time since December 25th, 1894. A mild spell followed, continuing to the 24th, after which temp. fell again, and remained below the average to the end of the month. Mean temp. 44°·1, one degree above the average. Fog on 6 days. High winds on 13 days, reaching the force of a gale on the 23rd, 24th and 28th. S or sleet fell on 4 days, and H on 6 days. The temp. exceeded 50° in the screen on 13 days. Brilliant aurora borealis on the 13th. L on the 24th.

EDENFEL.—The month was generally stormy, rainy and unsettled, with little frost or S, but more R than was suitable for the prosecution of farm work, already extremely backward from the prolonged and severe winter.

NOTICES.

It is requested that all Books for Review, and Commun
the Editor be addressed to him at 62, Camden Square, Lond

The responsibility for all facts and opinions expr
letters published in this Magazine rests with their respectiv

THE OBSERVATO

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., S
(Savilian Professor of Astronomy,)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, F

Contains full Reports of the Meetings of the Royal Astro
Meteorological Societies, and of the British Astronomical A
by various eminent Astronomers, English, American,
Correspondence on topics of interest connected with the
Observatories. Publications and current Discoveries. N
Variable Stars, on Lunar Formations, etc., also are suppli
and direction of observers.

The Observatory was founded in 1877, and has become an estab
publication.—*Prof. Young*, in "*Ten Years' progress in Astronomy*."

All communications should be addressed to the Editors o
Royal Observatory, Greenwich, S.E.

nnual Subscription (for the "Companion" and twelve M

SYMONS'S
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THE FROST—EARTH TEMPERATURES & WATER PIPES.

Continued from page 40.

IT would be beyond the scope of a note in this Magazine to prepare an analysis of all earth temperature records, but Mr. Rogers Field has directed our attention to some given in an American work,† which is hardly likely to be generally known to meteorologists, and from which we have therefore formed the following table:—

Winter Earth Temperature Observations in the United States.

Place.	Year	Month.	Air.			Minimum in Soil.							
			Max.	Min.	Mean	3 in.	6 in.	1 ft.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.
			°	°	°	°	°	°	°	°	°	°	°
State College Philadelphia.	1890	Nov.	66	17	41·2	33·5	35 0	37·5	40·5	...	...	...	...
	,,	Dec.	47	1	25·6	32·0	33·0	34·5	36·5	...	...	...	...
	1891	Jan.	49	1	28·9	23·0	27·0	33·0	34·5	...	...	...	...
	,,	Feb.	58	4	33·1	23·5	27·5	33·0	34·0	...	...	...	...
	,,	Mar.	54	0	31·6	24·0	30·0	33·0	34·0	...	...	...	...
	,,	April	82	20	49·5	31·5	33·0	35·0	36·5	...	...	...	...
S.Anthony Park, Minnesota	1890	Jan.	38	10	25	15	...	18	24	31	34	36	37
	,,	Feb.	46	—3	17	6	...	18	18	25	30	33	34
	,,	Mar.	62	14	44	21	...	26	25	26	30	32	34
	,,	April	68	42	56	46	...	35	32	32	32	33	39
Lincoln, Nebraska.	1890	Nov.	66·0	20	38·9	32·0	...	40·0	45·0	48·0	...	...	...
	,,	Dec.	59·5	5	30·9	23·0	...	34·0	39·0	41·7	...	...	...
	1891	Jan.	...	...	27·9	22·7	...	31·4	35·7	38·5	...	...	...
	,,	Feb.	...	...	20·1	14·6	...	24·2	31·4	34·8	...	...	...
	,,	Mar.	...	...	28·4	16·4	...	22·8	30·0	33·2	...	...	...
	,,	April	...	...	53·4	33·7	...	35·7	36·2	36·5	...	...	...
	,,	Nov.	78·0	3·0	34·5	26·3	...	37·3	42·8	46·0	...	...	...
	,,	Dec.	64·5	—1·0	32·6	29·2	...	35·0	39·0	42·0	...	...	...
Fort Collins, Colorado.	1890	Jan.	39·8	9·6	24·7	28·0	29·4	31·1	33·8	36·2	...	...	42·0
	,,	Feb.	45·0	15·0	30·0	32·5	33·3	33·6	34·6	36·0	...	...	46·0
	,,	Mar.	52·9	23·2	38·0	39·2	39·5	38·6	38·2	38·3	...	...	40·8
	,,	April	60·0	33·1	46·6	47·1	47·7	47·3	46·1	45·2	...	...	44 6
	,,	Nov.	54·9	21·3	38·1	36·7	38·2	40·8	44·2	46·7	...	...	52·1
	,,	Dec.	49·6	18·3	34·0	32·1	33 3	35·5	38·0	40·5	...	...	46·7

† Sewage Disposal in the United States, by G. W. Rafter, M.Am.Soc.C.E.; and M. N. Baker, Ph.B.: New York, 1894.

REMARKS.

Philadelphia.—Nearly 3 ft. of snow in December, 1890.

S. Anthony.—The max. and min. mean are merely those of daily readings at 2 p.m. The soil was bare of snow during February, hence the great penetration of the frost. The authors say:—"These Minnesota observations are of special interest, as illustrating the time required for the ground to free itself from frost when once frozen. The mean air temperature for March [at 2 p.m. ED.] was 44°, with a mean soil temperature at the depth of three inches of 41°. At the depth of two feet, 32° was not reached until March 28th, and it remained at that point till April 5th. These results show the considerable length of time required for the soil, and entrained moisture, to recover its lost latent heat. In winters of extreme cold the soil of Minnesota is said to freeze to the depth of six feet."

Before concluding our remarks upon the above subject, we have to insert a few further particulars respecting soil temperature.

To the Editor of the Meteorological Magazine.

SIR,—Referring to your article in the *Monthly Meteorological Magazine* of April on Earth Temperatures, perhaps the following may be found interesting from the temperatures having been taken in a different way from usual. I use a Negretti and Zambra's slow action thermometer, having the bulb encased in paraffin, as used by the British Association Committee on Rock (Underground) temperatures. This is buried in ground exposed to, and on a slope facing, S.E. at a depth of 1 ft., and is dug up twice a month. On February 15th the ground was frozen to the depth of 10 or 11 inches. The following are the temperatures this year and last:—

	1895.	1894.
	°	°
January 1	39·8	42·0
,, 16	36·2	41·8
February 1	36·2	43·2
,, 15	33·0	44·0
March 1	34·2	43·2
,, 16	43·4	44·0
April 1	44·1	50 1
,, 15	47·8	50·1

The soil is a decomposed clay slate, with many fragments of the rock, and the slope is a sharp one.—Yours truly,

ALFRED O. WALKER.

Nant-y-Glyn, Colwyn Bay.—April 22nd, 1895.

To the Editor of the Meteorological Magazine.

SIR,—If you could spare time to glance at the daily readings of our Southport 1-ft., 4-ft., and 10-ft. earth thers. which are printed in the weekly returns I send you, you would, I think, see that they agree *well* with Blackpool, and *fairly* with Bolton. But much must depend on the freedom (artificial or natural) of the ground around the thers. *from snow.* Some observers clear it away. Others (the majority, I hope) do not. But I doubt the desirability of allowing the iron tubes and caps to project six inches or so out of the ground. The snow soon melted away for some distance around mine.

Yours faithfully,

JOSEPH BAXENDELL.

The Observatory, Birkdale, Southport, April 18th, 1895.

Mr. Baxendell's values are within a tenth of a degree of those for Bolton. The entry for the table on p. 39 would be—

Southport Observatory, Lancashire 32°·3 31°·1 1°·2

and for the table on p. 40 -

Lancashire, Southport Observatory

31°·1 —— 36°·4 31°·1 32°·9 34°·3 35°·3

We therefore see no probability whatever that the natural soil at Southport was frozen 2 ft. below the surface.

Looking back over all the thermometric records we adhere to our original opinion that at no spot in England did the natural soil in its normal condition become frozen at the depth of 2 ft.

BURST WATER PIPES.

We now turn to the evidence on the other side, proving that water-pipes and mains were frozen at 2 ft. and at much greater depths.

We give, first, a few notes as to the mischief wrought in different towns. This list is not to be assumed to be complete or authoritative. No effort has been made towards ensuring either, as the sole object is to give typical information.

WEST HAM.—March 28th.—More than half our houses are waterless, and some have been in this state for nearly eight weeks.

BRIGHTON.—Serious splits occurred along the London Road, and the engineer reported on April 2nd that he had already relaid 440 yards of 4-inch and 100 yards of 3-inch mains at the depth of 2 ft. ; the old ones had been at from 1 ft. 2 in. to 2 ft.

READING.—Since the end of February 250 fractures in 4 in. mains, and 665 fractures in 3 in. mains, have been discovered and repaired, and during the same period over 500 service pipes have been made good. There are still (May 2nd) many leakages.

In the village of Burghfield all the mains near the Hatch Gate were burst, and have been replaced by new ones.

MAIDENHEAD.—The mains are mostly laid at 2 ft. 6 in. and many of them are burst.

FENNY STRATFORD (BUCKS).—March 29th.—The overtime worked in pumping was reasonable considering the amount of water required, owing to some extent to the bursts in the mains.

HONITON.—Water supply very much interfered with, the mains in the principal streets having been burst.

SHREWSBURY.—The pipes supplying Severn water burst in more than 50 places and the conduits in about 10. The bursts have been chiefly in the suburbs. On March 21, mains 2 ft. 6 in. below the surface were still blocked.

WOLVERHAMPTON.—The breakages were 135 two-inch pipes,
209 three ,, ,,
37 four ,, ,,
1 six ,, ,,
1 eight ,, ,,
and about 350 street services.

BIRMINGHAM.—The estimated number of bursts in private houses is put at 2,000, and the cost to the Corporation for repairs and for supply (£100 a day up to February 27th) about £3,000.

LEAMINGTON.—Cost of injury to mains about £900.

COVENTRY.—The severe frost caused considerable damage to the water mains. The water became frozen, even at more than 2 ft. below the surface.

CHESTERFIELD.—March 21st.—Frost not yet entirely out of the system. One pipe at Newbold was frozen at the depth of 28 inches. Total bursts about 600, but not many mains.

DERBY.—The total bursts in private houses were 3,490, and of street mains, 40.

LIVERPOOL.—There are in Liverpool 1,030 courts, containing 6,180 houses, supplied by standpipes, these often freeze, and about 20 men were engaged continually in trying to keep them in action. 128 men were engaged in connection with temporary standpipes, they rang bells when the pipes were delivering. At the time of greatest severity probably (besides the courts already mentioned) 27,000 houses were without supply—they were, however, all supplied by standpipes, except four blocks in the suburbs where the main was frozen and a cart service was substituted. The smallness of the number of mains frozen is attributed to (*a*) their depth, (*b*) the maintenance of constant supply and therefore continuous motion. Besides the above-mentioned 148 men, about 200 were employed in packing, and keeping free, the fire hydrants. Of street pipes 407 were burst, all but 15 being of less than 5 inches diameter, and most of them old ones laid at shallow depths; the total of lead pipes burst is put at 19,536, and more than 600 hydrants were damaged. The total cost to the Corporation was about £6,000.

OLDHAM.—March 30th.—It was reported that nearly all breakages had been made good.

BACUP.—The pipes conveying the water from the source to the main were split in many places.

KEIGHLEY.—There had been hundreds of bursts.

SHEFFIELD.—In the second week of March, and notwithstanding the thaw, nearly 170,000 persons were without proper water supply, and according to the report of the Engineer, published March 11th, the district service pipes had been frozen in 21 places at depths of and exceeding 1 ft. 6 in.

April 27th.—Nearly 500 men have been at work during the week repairing mains, but fresh fractures reveal themselves.

HUDDERSFIELD.—Repairs of burst pipes cost the Corporation £250, and extra labour in delivering water cost £550.

RIPON.—Water mains burst in several parts of the city, but they were mostly only 2-inch.

WORKINGTON.—Even on April 20th the supply is intermittent as, though the mains are all repaired, many services remain leaky.

BUILTH.—Much inconvenience has arisen from the water mains being frozen.

ST. ASAPH.—The service main burst in more than 20 places.

COLWYN BAY.—The bursts along the promenade at Rhos were so numerous that the main was practically useless.

SELKIRK.—March 28th.—So many bursts have occurred that no attempt will be made to repair, but new mains will be laid throughout.

MUSSELBURGH.—On February 27th a service pipe was found frozen at the depth of 37 inches in soil under whinstone blocks, and nearly at sea level.

ALLOA.—Roads reported in very bad state owing to numerous burst pipes.

INVERNESS.—Mr. Macdonald, water manager, on May 1st, reported:—"Every effort is being made to carry out your instructions as regards the restoration of the water supply to its normal state; but this is found to be a most difficult undertaking, as leaks and bursts, both in main and service pipes, are found to be universal. However, with the exception of Kessock Road, where men are employed uncovering the pipes, the supply of water is restored, but the pressure is not yet sufficient in many cases to rise to the cisterns. Almost in every case where the pipes were frozen they were also burst, and their renewal thus became imperative. If the leaks showed any indication on the surface of the ground it would be an easy matter to overcome them, but in most cases there was no appearance of leakage. For instance, on April 30th, in King Street, a 3-inch pipe was discovered with about two feet by two inches of the metal entirely severed from the pipe, yet not a drop came to the surface, and its discovery was due to an all-night inspection of the sewers. Again, in Glen Urquhart Road, the pipes were nearly all found split, and the water not rising above the pipes. The same remarks apply to many other roads in and around the town. I suspect that there are leakages at present going on in Kenneth Street, Telford Street, Attadale Road, Harrowden Road, Culduthel Road, and probably many other places, in addition to a host of service pipes. Strenuous efforts will continue to be made to overcome this serious state of matters."

The above extracts will suffice to prove—

(1) The wide area of the trouble—from Devon to Inverness.

(2) That pipes were found containing ice 28, 30, and 37 inches below the surface. In the report (on p. 62) of the meeting of the Royal Meteorological Society, 42 inches is mentioned, and in the subjoined note* 54 inches.

(3.) The great cost which has fallen upon most of the large towns.

Several correspondents have suggested that which we believe to be the real explanation of the apparent contradiction, but before proceeding to sum up the evidence, we reprint two letters, which tell a story very different from the above.

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* A correspondent, signing himself "Amateur," stated that in the South of London the ground was frozen to a depth of 4 ft. 6 in. As our lowest temperature at 4 ft. was 37°·1, corresponding to nearly 38° at 4 ft. 6 in.. we doubted the statement and wrote for particulars. They are most precise and positive; our correspondent says that it was in digging down to repair a large driving main at Upper Tulse Hill, that the man was positive as to the correctness of the depth, and added that in Lower Tulse Hill the penetration was 3 ft. 5 in. to 3 ft. 7 in.

DEPTH OF WATER MAINS.

To the Editor of the "Standard."

SIR,—About the depth to which water mains should be laid, I venture to ask space in *The Standard* for the following experiences relating thereto.

The mains of Lord Salisbury's Hatfield and district water supply, which now have been in use for about four years, have a minimum depth from the surface to the tops of the sockets of two feet six inches. But, nothwithstanding this exceptional depth, we have a three-inch main, in which for a short distance, and in an exposed situation, the water became frozen on the 23rd of last month. On opening the ground, this partially frozen main was found to be three feet three inches below the surface of the London road, showing how necessary it is to lay water mains so that the tops of their sockets shall, at least, be two feet six inches in depth.

This partially frozen main would have remained unfrozen but that it has a closed or "plugged" end, and thus the circulation of water through it was, for the greater part of the night, inappreciable.

Owing to the depth to which they were laid, Hatfield and district water mains, extending in town and country to about three miles, remained in a practical sense unaffected by this year's abnormally severe frost, so much so, indeed, that we have not had a burst pipe in any of the mains.

I am, Sir, your obedient servant,

JOHN MILLER.

Hatfield, March 28.

On seeing the above letter we asked the writer to favour us with replies to a few questions, which he kindly did, and they may be thus epitomized.

The water is pumped from a well 300 ft. deep, in which there is generally 150 ft. of water, the usual temperature is 51°, it is pumped into an uncovered reservoir, of which the surface became frozen, and the ice had to be broken to ensure proper pressure in the mains. The pipes are extra thick, and even the frozen one did not burst.

WATER PIPES AND THE FROST.

To the Editor of the "Surrey Advertiser."

SIR,—I have read so many letters in various newspapers on the subject of frozen water mains and consequent stoppage of supply, in some cases for several weeks, that I thought perhaps our experience here would not only interest, but might possibly be of use to some of your readers. This company has nearly eight miles of mains, none of which have been frozen this season, nor has the supply been interrupted for a single day. The mains were laid to a depth of 2ft. to the top of the sockets of the pipes, and in the few parts of the system where it was impracticable to do this, the main was wrapped with

felt or flannel, passed through a larger pipe, and the ends of this made secure. Moreover, during the late severe weather, the valves and hydrants were daily inspected and kept thawed where necessary. To these simple precautions I attribute our immunity from the troubles that appear to have overtaken so many water companies and their customers during the past winter.—I am, &c.,

STEPHEN ROWLAND.

Cranleigh Water Company, Limited, April 22, 1895.

We wrote also to Mr. Rowland, and his reply states :—

The water is derived from very deep seated springs from the Lower Greensand, it leaves the springs at about 50°, and then goes into a covered reservoir, whence it is distributed.

Hence, in both these cases the water was from deep sources ; and though at Hatfield it was allowed to cool so as to freeze on the surface, it is probable that the supply on entering the main was considerably above 32°.

Now we come to the end of the subject. We believe that the key to the contradiction is, not that the frost went down through the soil to the pipes, but that water was forced into the pipes at a temperature within a few degrees of freezing point, that the continued passage of this cold liquid chilled the pipes, and the ground around them, and so the soil between the pipes and the surface was chilled both from above and from below. This, however, of itself, would not turn water into ice—but there are two other facts which we believe completed the disaster. Every shallow service pipe is a metallic (and therefore excellent) conductor of heat and of cold, and every frozen service pipe was not merely useless to its owner, but was carrying cold down to the main. So also with the fire hydrants which swarm in our streets, but are designed rather for the climate of Madras than for that of St. Petersburgh. They are in perfect metallic connection with the mains, they come to the pavement at a temperature of, in many cases, 30° below freezing, and conduct some of that cold down to the mains.

When, as at Sheffield, and other towns, you draw water from a frozen reservoir, or, as at London, you draw it from a river on which we ourselves were walking within sight of the intake of some of the companies, you draw a liquid which may be said to need little more than repose to fly into the solid form. The deep laying of mains will be costly, and will, therefore, have many advocates, but when the pipes have to be filled with ice-cold water, we believe that the conduction of cold by service pipes and by hydrants will not be neutralized by an extra foot of depth.

Happily, on the authority of Messrs. Bayard and Marriott, we hear that there has not been such a frost for 80 years, may it be another 80 before Britons have a like experience.

AN EARLY RECORD OF SEA-SPRAY CARRIED BY A GALE.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the correspondence in the *Met. Mag.* of January, 1895, I venture to send you the following extract from Hone's "Every Day Book," vol. ii. :—

"REMARKABLE STORM."

"The following remarkable letter in the *Gentleman's Magazine* relates to the present day seventy years ago.

'*Wigton, Oct.* 23, 1756.

'MR. URBAN,

'On the 6th inst., at night, happened a most violent hurricane; such a one, perhaps, as has not happened in these parts in the memory of man. It lasted full 4 hours, from about 11 till 3. The damage it has done over the whole country is very deplorable. The corn has suffered prodigiously. Houses were not only unroofed, but in several places overturned by its fury. Stacks of hay and corn were entirely swept away. Trees without number torn up by the roots. Others snapt off in the middle, and scattered in fragments over the neighbouring fields. Some were twisted almost round; bent, or split to the roots, and left in so shattered a condition as cannot be described.

'The change in the herbage was also very surprising; its leaves *withered, shrivelled up, and turned black.* The leaves upon the trees, especially on the weather side, fared in the same manner. The *evergreens* alone seem to have escaped, and the grass recovered in a day or two.

'I agreed, at first, with the general opinion, that this mischief was the effect of *lightning*; but, when I recollected that, in some places, very little had been taken notice of; in others none at all; and that the effect was *general*, I began to think of accounting for it from some other cause. I immediately examined the dew or rain which had been left on the grass, windows, etc., in hopes of being able, by *its taste*, to form some better judgment of the particles with which the air had been impregnated, and I found it as salt as any sea-water I had ever tasted. The several vegetables were also all saltish more or less, and continued so for 5 or 6 days, the saline particles not being then washed off; and when the moisture was exhaled from the windows, the saline christal *sparkled* on the outside, when the sun shined, and appeared very *brilliant.*

'The *salt water*, I conceive, has done the principal damage, for I find upon experiment, that common salt dissolved in fresh water affected some fresh vegetables, when sprinkled upon them, in the very *same manner*, except that it did not turn them quite so black, but particles of sulphurous, or other quality,* may have been mixed with it.

'I should be glad to see the opinions of some of your ingenious correspondents on this wonderful phenomenon—whether they think this water was brought from the sea,† and in what manner.

'Yours,

A. B.'

* 'In an adjoining bleach-yard, some clothes which had lain out all night was turned almost yellow. Other pieces also which were spread out the next morning contracted the same colour, which was not without great difficulty washed out.'

† 'The wind was easterly [?—ED.], and consequently in its passage swept the Irish Sea.'

Yours truly,

FRED. COVENTRY.

Ketton, Stamford, April, 13th, 1893.

Neudrucke von Schriften und Karten ueber Meteorologie und Erdmagnetismus, herausgegeben von PROF. DR. HELLMANN. No. 4. E. HALLEY, W. WHISTON, J. C. WILCKE, A. VON. HUMBOLDT, C. HANSTEEN. Die ältesten Karten der Isogonen, Isoklinen, Isodynamen, 1701—1826. 4to, Assher & Co., Berlin and London, 1895, 25pp., 7 Maps.

The Earliest Isoclinics and Observations of Magnetic Force, by L. A. BAUER [Bull. Phil. Soc., Washington.] 8vo., Washington, 1894. 14 pp.

Beitrage zur Kenntniss des Wesens der Säcular-Variation des Erdmagnetismus von L. A. BAUER. Berlin, 1895, royal 8vo, 56 pp. 2 folding plates.

WE have said so much as to the excellence both in knowledge and in typography of Dr. Hellmann's *Neudrucke* that we need do little more than mention the appearance of No. 4. But we have coupled with it the title of Dr. Bauer's paper read before the Philosophical Society of Washington, because he and Dr. Hellmann each deal with Whiston's pamphlet* and both seem to consider that its "discovery" is something new. We do not agree with this; the standard authority upon Electrical and Magnetical works (until our American friends fulfil their promise and publish the Bibliography of Meteorology), is the Ronald Catalogue; Whiston's book is duly quoted, and is itself in the Ronald library. Merely from catalogues on our own shelves we see that there are copies at the Royal Society, Royal Astronomical Society, University College, and the Institution of Civil Engineers; this, with the one in our own collection, makes six, irrespective of the British Museum and several other libraries in which we expect that it would be found, so that probably

* WHISTON, W., M.A. "The Longitude and Latitude found by the Inclinatory or Dipping Needle; wherein the Laws of Magnetism are also discovered." 8vo., London, 1721.

there are quite a dozen copies in London alone. If Dr. Hellmann is correct (and it will be wonderful if he is not) in saying, "sie in Keinem den Erdmagnetismus behandelnden Werke erwähnt werden," we think that a modification of George Stephenson's celebrated answer respecting the cow and the railway train, would be appropriate: "So much the worse for the —— works on Terrestrial Magnetism." Probably the real explanation is, that hitherto no one has attempted to work up the history of the progress of Magnetic observation; Dr. Hellmann's few pages are excellent as far as they go, and Dr. Bauer's second work shows both ability and interest in the same direction, so perhaps, ere very long, something may be done towards issuing a complete monograph.

ROYAL METEOROLOGICAL SOCIETY.

AT the meeting of this Society, on Wednesday evening, April 17th, which was held at the Surveyors' Institution, Westminster Messrs. F. C. Bayard and W. Marriott communicated a paper on "The Frost of January and February, 1895, over the British Isles," The cold period which commenced on December 30th, and terminated on March 5th, was broken by a week's mild weather from January 14th to 21st, otherwise there would have been continuous frost for 66 days. Temperatures below 10° Fahrenheit, and in some cases below zero, were recorded in parts of England and Scotland between January 8th and 13th, while from the 26th to the 31st, and from February 5th to 20th, temperatures below 10° occurred on every day in some part of the British Isles. The coldest days were February 8th to the 10th. The lowest temperature recorded were—17° at Braemar and—11° at Buxton and Drumlanrig. The mean temperature of the British Isles for January was about 7°, and for February from 11° to 14° below the average, while the mean temperature for the period from January 26th to February 19th was from 14° to 20° below the average. The distribution of atmospheric pressure was almost entirely the reverse of the normal, the barometer being highest in the north and lowest in the south, the result being a continuance of strong, northerly, and easterly winds.

The effect of the cold on the public health was very great, especially on young children and old people. The number of deaths in London due to diseases of the respiratory organs rapidly increased from February 2nd to March 2nd, when the weekly number was 1,448, or 945 above the average. Rivers and lakes were frozen, the ice being more than 10 inches thick.

The frost will long be remembered for its effect on the water-pipes all over the country, in many cases the householders being without water for more than nine weeks. As the result of enquiries the authors find that mains have frozen which have been laid as low as

3 ft. 6 ins. from the surface of the ground to the top of the pipe. It appears, however, that the nature of the soil had far more to do with the depth to which the frost penetrated than the intensity of the frost itself.

From a comparison of previous records, the authors are of opinion that the recent frost was more severe than any since 1814.

Mr. Southall spoke of the similarity of the frost to that of 1814, known in the West of England as the twelve weeks' frost, and said that in that year the snow was over the hedges, and everything was protected by it.

Mr. Leeson Prince said that the mean temp. of February, 1895, was the lowest recorded in any month from 1842 to the present time, but that owing to the height of Crowborough above sea level (774 ft.) the extreme minimum in shade was only 12°·8. At East Grinstead the ice on a pond was 13½ inches thick.

Mr. Percy Bicknell said that at the Skating Club in Regent's Park the members skated for 50 consecutive days. At Swavesey Fen, Cambridgeshire, his son found the ice to be two feet thick.

Mr. Symons referred to the protection afforded by snow, and to the effect of the pressure and motion of the water in mains, on the formation of ice therein.

Mr. C. Harding raised the question of the definition of a great frost—whether it should be reckoned by the period during which the min. was below 32°, or during which the max. did not rise above 32°, &c.; he also quoted various particulars relating to previous frosts. The President, Mr. Jackson, Mr. Dines, and Mr. Tripp also took part in the discussion.

Mr. Birt Acres also read a paper on "Some Hints on Photographing Clouds," illustrated by exceptionally beautiful photographs of clouds.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	62·1	2*a*	31·2	17	56·9	45·2	45·8	85	101·9	29·2	4·45	17	7·6
Malta	90·1	19	59·4	15	81·1	67·8	65·3	79	136·9	55·2	1·62	4	4·7
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	82·3	26	60·3	16	79·0	66·1	61·2	72	133·6	49·9	1·11	14	5·3
Calcutta	88·4	7	65·9	31	85·8	75·4	76·0	87	155·3	60·5	4·41	12	4·5
Bombay	89·4	21	72·3	31	85·6	76·1	75·0	83	142·5	64·8	3·08	13	5·5
Ceylon, Colombo	87·9	12	72·8	...	85·3	75·7	72·6	82	147·2	68·0	20·81	23	7·0
Melbourne	87·1	23	39·3	12	70·1	50·3	51·0	76	143·7	33·9	3·84	17	5·8
Adelaide	91·5	22	43·1	19	72·0	53·0	48·8	64	153·5	36·5	2·97	14	5·9
Sydney	77·9	26	49·7	9	69·9	57·1	56·7	75	146·4	41·7	2·54	23	5·0
Wellington	71·0	28	36·3	6	61·9	49·0	46·3	72	132·0	23·0	·42	7	4·4
Auckland	71·0	22	42·5	4,5	65·6	51·0	51·5	78	138·0	40·0	1·16	10	4·0
Jamaica, Kingston	90·3	31	67·0	25	86·7	71·5	71·6	84	...	...	12·78	14	4·7
Grenada	85·8	11	17·8	5,6	32·8	74·6	72·0	76	157·2	...	10·55	18	4·0
Trinidad	90·0	*b*	68·0	6	87·8	72·1	70·9	79	170·0	66·0	3·92	22	...
Toronto	67·3	3	33·3	15	57·3	43·3	42·0	79	...	27·0	2·35	17	6·6
New Brunswick, Fredericton	61·0	8	25·4	13	54·6	36·3	39·6	79	...	...	4·32	15	6·3
Manitoba, Winnipeg	67·7	15	18·5	30	51·6	30·9	...	...	...	...	1·79	13	6·3
British Columbia, Esquimalt	62·1	15	32·7	18	54·0	41·4	45·6	92	...	...	4·60	19	7·6

a—and 11, 13. *b*—Various.

REMARKS.

MALTA.—Adopted mean temp. (73°·1), 4°·2 above the average. Mean hourly velocity of wind 7·5 miles. Sea temp. averaged 75°·0. Thunderstorms on 1st, 2nd, 12th, and 13th, and lightning on 6 other days. The max. in sun in July was 147°·4 on 12th, not as printed. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·1, of dew point 0°·5, and rainfall ·62 in. below, their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·9 mile below average; extremes 32·0 on 29th and 2·2 on 28th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

Adelaide.—Mean temp. 0°·6 above, and rainfall 1·11 in. above, the average of 37 years. Good general rains this month. C. TODD, F.R.S.

Sydney.—Temp. 0°·2 above, humidity 5°·9 above, and rainfall ·40 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Generally fine throughout the month; unusually small rainfall. Prevailing N.W. winds, and strong from that quarter during the middle of the month; also strong from S.W. in the beginning of the month. Mean temp. 1°·8 above the average; rainfall 3·95 in. below, or less than one-tenth of, the average. R. B. GORE.

Auckland.—An unusually fine and dry month, the only rain of consequence falling on the 28th and 31st. Barometric pressure and mean temp. both largely above the average; rainfall very small, and not one-third of the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 3·4 miles. Rains known as "Seasons" general all over the island, the fall being one-third in excess of the average and many stations having twice their average or more. R. JOHNSTONE.

TRINIDAD.—Rainfall 2·75 in. below the 30 years' average. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	2·38	XI.	Lake Vyrnwy	2·71
,,	Birchington, Thor	·99	,,	Corwen, Rhug	1·82
,,	Hailsham	2·24	,,	Carnarvon, Cocksidia ...	3·28
,,	Ryde, Thornbrough	2·56	,,	I. of Man, Douglas	2·98
,,	Emsworth, Redlands ...	2·34	XII.	Stoneykirk, Ardwell Ho.	2·12
,,	Alton, Ashdell.....	2·22	,,	New Galloway, Glenlee	3·67
III.	Oxford, Magdalen Col...	1·62	,,	Melrose, Abbey Gate ...	1·01
,,	Banbury, Bloxham	1·75	XIII.	N. Esk Res. [Penicuick]	1 50
,,	Northampton, Sedgebrook	1·37	,,	Edinburgh, Blacket Pl..	1·17
,,	Alconbury	1·04	XIV.	Glasgow, Queen's Park.	1·05
,,	Wisbech, Bank House..	1·59	XV.	Inverary, Newtown	5·03
IV.	Southend	·95	,,	Islay, Gruinart School..	·89
,,	Harlow, Sheering	·84	XVI.	Dollar.....	1·88
,,	Colchester, Lexden.....	·94	,,	Balquhidder, Stronvar..	7·20
,,	Rendlesham Hall	·77	,,	Ballinluig	1·78
,,	Diss	·88	,,	Dalnaspidal H.R.S. ...	4·46
,,	Swaffham	1·54	XVII.	Keith H.R.S.	·97
V.	Salisbury, Alderbury...	2·84	,,	Forres H.R.S.	1·38
,,	Bishop's Cannings	2·60	XVIII.	Fearn, Lower Pitkerrie.	...
,,	Blandford, Whatcombe.	2·95	,,	Loch Shiel, Glenaladale	6·22
,,	Ashburton, Holne Vic....	2·99	,,	N. Uist. Loch Maddy ...	3·96
,,	Okehampton, Oaklands.	2·53	,,	Invergarry	3·64
,,	Hartland Abbey	2·10	,,	Aviemore H.R.S.	1·69
,,	Lynmouth, Glenthorne.	1·87	,,	Loch Ness, Drumnadrochit	2·37
,,	Probus, Lamellyn	2·04	XIX.	Invershin	1·68
,,	Wellington, Sunnyside..	2·19	,,	Scourie	2·90
,,	Wincanton, Stowell Rec.	2·63	,,	Watten H.R.S.	1·96
VI.	Clifton, Pembroke Road	2·63	XX.	Dunmanway, Coolkelure	5·66
,,	Ross, The Graig	2·60	,,	Fermoy, Gas Works ...	2·78
,,	Wem, Clive Vicarage ...	1·81	,,	Killarney, Woodlawn ...	3·24
,,	Cheadle, The Heath Ho.	2·23	,,	Caher, Duneske	2·03
,,	Worcester, Diglis Lock	1·82	,,	Ballingarry, Hazelfort...	1·75
,,	Coventry, Coundon	2·16	,,	Limerick, Kilcornan ...	1·54
VII.	Ketton Hall [Stamford]	1·26	,,	Ennis	3·23
,,	Grantham, Stainby	1·87	,,	Miltown Malbay.....	2·58
,,	Horncastle, Bucknall ...	1·38	XXI.	Gorey, Courtown House	2·12
,,	Worksop, Hodsck Priory	2·18	,,	Athlone, Twyford	1·82
VIII.	Neston, Hinderton	1·78	,,	Mullingar, Belvedere ...	1·45
,,	Preston, Haighton	...	,,	Longford, Currygrane...	1·69
,,	Broughton-in-Furness..	3·47	XXII.	Woodlawn.....	1·35
IX.	Ripon, Mickley	2·22	,,	Crossmolina, Enniscoe..	2·09
,,	Melmerby, Baldersby ...	1·63	,,	Collooney, Markree Obs.	2·54
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	1·16	XXIII.	Lough Sheelin, Arley ..	1·71
X.	Haltwhistle, Unthank..	1·55	,,	Warrenpoint	3·91
,,	Bamburgh.....	·93	,,	Seaforde	2·61
,,	Keswick, The Beeches...	2·81	,,	Belfast, Springfield	2·18
XI.	Llanfrechfa Grange	3·00	,,	Bushmills, Dundarave...	1·28
,,	Llandovery	2·11	,,	Stewartstown	1·64
,,	Castle Malgwyn	4·16	,,	Buncrana	1·70
,,	Builth, Abergwessin Vic.	3·68	,,	LoughSwilly, Carrablagh	1·71
,,	Rhayader, Nantgwillt..	3·21			

APRIL, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATUR Max. Deg.	Date	Min. Deg.	D
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	1·34	— ·40	·61	25	13	67·1	29	29·1	
II.		Maidstone (Hunton Court)...	1·21	— ·44	·45	25	13	...	...	...	
,,		Strathfield Turgiss	1·71	+ ·11	·61	24	9	65·5	19	26·4	
III.		Hitchin	1·08	— ·71	·48	25	13	63·0	11*b*	28·0	
,,		Winslow (Addington)	1·45	— ·47	·56	25	12	63·0	6 dys	28·0	
IV.		Bury St. Edmunds (Westley)	1·33	— ·33	·64	25	9	64·0	17	30·0	
,,		Norwich (Brundall)	1·20	...	·18	1*a*	11	65·8	20	29·0	
V.		Weymouth(LangtonHerring)	2·36	+ ·48	·88	24	13	60·0	17*c*	33·0	1
,,		Torquay (Cary Green)	2·43	...	·70	22	13	60·3	10	33·6	
,,		Polapit Tamar [Launceston]..	2·42	+ ·20	·45	22	16	62·5	17	29·0	
VI.		Stroud (Upfield)	2·99	+ ·84	·68	24	14	64·0	17*d*	34·0	
,,		ChurchStretton(Woolstaston)	2·24	— ·10	·93	25	17	69·0	30	28·0	
,,		Tenbury (Orleton)	2·14	+ ·06	·51	25	14	62·7	21	28·0	
VII.		Leicester (Barkby)	1·72	— ·38	·47	25	13	67·0	29	25·0	
,,		Boston	1·49	— ·22	·56	25	10	70·0	28	29·0	
,,		Hesley Hall [Tickhill].....	1·66	— ·05	·57	25	10	66·0	21	29·0	
VIII.		Manchester(PlymouthGrove)	1·36	— ·35	·50	25	10	65·0	30	29·0	
IX.		Wetherby (Ribston Hall) ..	1·20	— ·65	·56	26	5	...	...	...	
,,		Skipton (Arncliffe)	3·41	— ·02	·99	22	12	...	...	...	
,,		Hull (PearsonPark)	1·19	— ·73	·30	22	12	65·0	20*f*	28·0	
X.		Newcastle (Town Moor)	1·31	— ·52	·71	25	11	...	...	...	
,,		Borrowdale (Seathwaite).....	8·30	+ 1·16	2·61	5	15	...	...	...	
XI.	WALES.	Cardiff (Ely).....	2·32	— ·09	·42	22	14	..	...	...	
,,		Haverfordwest	3·69	+ 1·06	1·07	22	16	64·0	17	26·0	
,,		Aberystwith (Gogerddan) ...	2·45	— ·11	·77	26	8	68·0	17	20·0	
,,		Llandudno.....	2·39	+ ·58	1·08	25	15	63·8	20	32·4	
XII.	SCOTLAND.	Cargen [Dumfries]	2·47	+ ·24	·76	22	10	62·4	17	27·0	
,,		Jedburgh (Sunnyside).....	1·52	— ·18	·47	25	11	63·0	30	26·0	
XIV.		Colmonell	2·89	...	·84	25	10	65·0	15	27·0	4
XV.		Lochgilphead (Kilmory).....	3·24	+ ·43	·65	5	17	...	...	23·0	
,,		Mull (Quinish).....	2·96	— ·02	·87	6	15	...	...	...	
XVI.		Loch Leven Sluices.....	1·80	— ·42	·40	23	9	...	...	...	
,,		Dundee (Eastern Necropolis)	1·15	— ·90	·25	25	12	63·1	22	27·4	
XVII.		Braemar	1·34	— 1·08	·36	25	15	59·0	18	25·0	
,,		Aberdeen (Cranford)	1·37	...	·29	25	15	57·0	21*g*	29·0	
XVIII		Strathconan [Beauly]	3·01	+ ·20	·70	26	7	...	...	...	
,,		Glencarron Lodge.....	5·89	...	1·40	5	23	66·0	18	26·5	
,,		Cawdor [Nairn]	1·74	+ ·22	·88	26	12	...	...	...	
XIX.		Dunrobin	1·62	— ·11	·29	26	13	61·0	23	32·0	
,,		S. Ronaldsay (Roeberry).....	2·80	+ 1·19	·71	5	17	...	...	29·0	
XX.	IRELAND.	Darrynane Abbey.....	2·78	...	·38	22	18	...	...	...	
,,		Waterford (Brook Lodge) ...	2·46	— ·01	·81	22	12	59·0	18	29·0	
,,		O'Briensbridge (Ross)	1·62	...	·38	5	16	..	...	...	
XXI.		Carlow (Browne's Hill)	1·87	— ·41	·41	22	15	...	..	...	
,,		Dublin (FitzWilliam Square)	1·15	— ·97	·25	26	13	64·0	21	32·9	
XXII.		Ballinasloe	1·19	— 1·15	·19	20	15	61·0	21	29·0	
,,		Clifden (Kylemore)	6·53	...	1·62	20	21	...	...	...	
XXIII		Waringstown	1·70	— ·72	·30	29	19	67·0	22	28·0	
,,		Londonderry (Creggan Res.).	2·04	— ·20	·52	23	19	...	...	...	
,,		Omagh (Edenfel)	2·04	— ·19	·27	18	17	60·0	15*h*	33·0	1

a And 19, 26. *b* And 20. *c* And 19. *d* And 23. *e* And 29. *f* And 21. *g* And 2
h And 16. *i* And 14. *k* And 12, 13, 15.

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The first part of the month was cold and rough; from the 7th to the 21st the weather was beautifully fine and dry, but with cold winds; the month closed with showery unsettled weather. The nesting of the birds singularly late. Horse chestnut in leaf on 17th. Blackthorn in flower on 20th.

ADDINGTON.—A rather sharp frost on the 1st, followed by a few days of low max. temp. and slight frosts from the 13th to the 15th. Altogether a favourable month. Distant thunder on 17th and 27th. Plum trees in full blossom at the end, quite a fortnight later than last year. Summer visitors rather early. Swallows seen on the 10th, cuckoo on the 17th, and nightingale on the 25th.

BURY ST. EDMUNDS, WESTLEY.—A fine month, with frost only on the 5th and 15th. Foreign birds arrived at the usual time. Vegetation as forward as the average. Swallow seen on 11th, Cuckoo on 12th, and Nightingale on the 14th. Thunder on 17th and 25th.

NORWICH, BRUNDALL.—A fine growing month; mean temp. 47°·3. Cold and bleak from 1st to 7th; dry and warm from 8th to 12th; warm, with R at times, from 19th to 27th.

LANGTON HERRING.—The weather was fine from the beginning of the month to the 16th, but unsettled from the 17th to the end. L on the 17th. Mean temp. at 9 a.m. 47°·5, 0°·2 above the average. Fogs were frequent, those on the 8th, 9th, and 30th being thick. Cuckoo heard on the 10th. Blackthorn in blossom on the 16th. Foliage of trees four weeks later than the average.

TORQUAY, CARY GREEN.—Rainfall ·26 in. below the average. Mean temp. 47°·8, or 1°·3 above the average. Duration of sunshine 167 hours, being 23 hours below the average; two sunless days.

POLAPIT TAMAR.—The month was rather wetter on the whole than usual. The first three weeks were dry and very favourable for agricultural work; the last ten days very wet.

STROUD, UPFIELD.—Slight TS from S.E. from 6 p.m. to 7 p.m. on 17th; T all the afternoon, and sheet L at night.

WOOLSTASTON.—The first half of the month was cold and backward, with sharp frosts on the ground on most nights. The latter part was warmer and more genial. The first swallow was seen on the 16th; the Cuckoo heard on the 18th. Mean temp. of the month 47°·3. H on the 1st.

TENBURY, ORLETON.—The first half of the month was very dry, but from the 16th to the end there was R nearly every day. The temp. of the month was about the average of 34 years. T on the 17th, 18th and 24th; L on 17th; cuckoo heard on the 12th, a week earlier than usual. Damson, cherry and plum trees in full blossom on the 30th. Sharp frosts on 5 days.

LEICESTER, BARKBY.—Some fine days, but often chilly, and even chillier nights in proportion. First swallow seen on the 9th, first cuckoo on the 19th. T on 1st. Meam temp. 46°·9.

MANCHESTER, PLYMOUTH GROVE.—A very fine month upon the whole. Summer weather from 9th to 17th, and generally fine to the end. Mean temp. 47°·8.

WALES.

HAVERFORDWEST.—Excepting the 17th, there really was not one day of warm shade-temp. in April. The temp. was about the average and the weather showery in the first week. Fine bright weather with north-easterly wind and keen ground frosts set in on the 11th, lasting to the 16th, when the conditions

gradually altered, the air became much milder, the wind southerly, and the weather fine but damp. The wind reached the force of a gale on the 21st, and R fell in large quantities up to the 27th; temp. again decreased, and the month ended cold but fine. Horse chestnuts in leaf on the 17th, currants and gooseberries also in about the same stage of advancement; blackthorn in blossom only on 27th, and not generally even then. Oak swelling, but ash making no sign. Grass lands looking remarkably well, and general appearance of the country promising. Cuckoo heard on 11th, and swallow seen on the 14th.

GOGERDDAN.—Dry and cold with N.E. winds during the first half of the month; the last fortnight showery, with wind S.W.

SCOTLAND.

CARGEN.—The chief characteristic of the month is the low sunshine record—only 121 hours; 46 hours less than the average for April during 36 years. The continuance of southerly winds for 8 days (18th to 25th) is quite exceptional, while east winds were much less prevalent than usual. The favourable winds, combined with a slight increase in the rainfall, and a more equable day and night temp. than usual, had a very marked effect on vegetation during the latter portion of the month, and pasture and corn crops more than made up their leeway occasioned by the unfavourable character of February and March. On the 9th the ground was still frozen 9 inches below the surface. T and L on 24th, and T on 25th.

JEDBURGH.—During the first two weeks the weather was cold, but towards the end, particularly the last ten days, it became much milder, and vegetation advanced rapidly. Most of the cereals were sown in good condition. Swallow seen on 23rd, cuckoo heard on 25th.

COLMONELL.—Rainfall ·59 in. above the average of 19 years.

ROEBERRY.—A wet, cold month. Mean temp. 44°·4.

IRELAND.

DARRYNANE ABBEY.—The first week was rather cold; the middle of the month fine and warm. The second half was unsettled, but mild, and vegetation made much progress.

WATERFORD, BROOK LODGE.—Swallows about the house on the 19th; Cuckoo heard on 25th, and Corncrake on 26th.

O'BRIENSBRIDGE, ROSS.—Moderate rain and rather low temp. up to the 20th. All vegetation three weeks later than the average, and fully a month later than in April, 1894

DUBLIN.—Speaking generally, April, 1895, was a favourable and an average month. The wind was singularly variable, blowing from all points of the compass in nearly equal proportion. The mean temp. (48°·1) was 0°·4 above the average. High winds were noted on nine days. Sleet and H fell on 1st, and H on 11th. The temp. exceeded 50° in the screen on every day except six. Aurora borealis on the 11th.

WARINGSTOWN.—Everything fully a month late.

EDENFEL.—On the whole a favourable and seasonable month, sufficiently fine in the early part for the prosecution of farm labour, and rainy in the latter half for purposes of vegetation. No appreciable frost.

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METEOROLOGICAL MAGAZINE.

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RAINFALL OBSERVATIONS IN CHINA, 1886-92,

By M. LE PROF. RAULIN.

WITH the year 1886 rainfall observations were commenced at many of the Chinese customhouses, and also by Missionaries at some towns on the Yang-Tse-Kiang river, in the centre of China, not far from the latitude of Shang-Hai, some of them nearly 700 miles inland. There were also five stations in Formosa and one in Hainan.

These observations have been published by Dr. Doberck, for the years 1886 to 1889, in the *Quarterly Journal of the Royal Meteorological Society*, and for the years 1890–92 in the *Observations and Results at the Hong Kong Observatory*.

We have thus information as to the rainfall of that part of Asia for from 5 to 7 years from 33 stations, which may be thus grouped :—

1. Southern coast of the Gulf of Pe-chi-li.
2. River Yang-Tse-Kiang.
3. Delta of the Yang-Tse-Kiang.
4. Coast from Wenchow to Swatow.
5. Canton and Hainan.
6. Formosa.

Mean annual rainfall.—This is small in the north, and increases greatly towards the south. From about 20 inches in the Gulf of Pe-chi-li, it becomes double that in the Delta of the Yang-Tse-Kiang, and going about 500 miles up the river we find 58 inches at Hankow. Continuing along the coast it is about 45 inches, but reaches 68 inches at Ningpo. At Canton it is 66 inches, in the north of the Island of Hainan 54 inches, in Formosa it ranges from 60 to 90 inches, but at Keelung, the N.E. point, it reaches 148 inches.

Seasonal distribution.—Notwithstanding the proximity of most of the stations to the sea, the régime is that of type I. which prevails over the greater part of Asia. The exceptions are Foochow, Middle Dog and Chapel Island, where the spring rains slightly exceed those of summer. The southern part of Formosa has also type I., but at Keelung, its northern extremity, we have the opposite, type IV., and at Tamsui, not far off, the intermediate type III.

Abstract of Rainfall in China, 1886–92.

Stations.	Long. E.	Lat. N.	Year.	Winter.	Spring.	Summr.	Autmn.	Year.
	° ′	° ′		in.	in.	in.	in.	in.
1. *South Coast of the Gulf of Pe-chi-li* :—								
Houki	120 39	38 4	6	0·09	1·71	10·91	3·21	15·92
Chefoo	121 32	37 34	6	1·93	2·20	17·02	4·45	25·60
Shangtung Promontory.	122 42	37 24	6	1·67	3·05	13·83	3·97	22·52
2. *Yang-Tse-Kiang R.* :—								
Ichang	111 19	30 12	7	3·26	12·47	21·43	7·92	45·08
Hankow	114 20	30 33	7	8·98	18 55	22·14	8·02	57·69
Kiukiang	116 7	29 43	7	7·97	19·26	20·05	8·13	55·41
Wuhu	118 22	31 22	7	5·64	11·87	15·21	7·48	40·20
Chinkiang	119 30	32 12	6	3·63	8·27	14·27	6·30	32·47
3. *Delta of the Yang-Tse-Kiang* :—								
Wusung	121 27	31 25	5	6·16	9·36	14·24	9·73	39·49
Shaweishan	122 15	31 25	6	7·35	8·16	14·73	10·53	40·77
North Saddle	122 40	30 52	5	7·19	7·31	10 21	7·26	31·97
Gutzlaff	122 11	30 49	4	5·95	7·80	12·53	5·78	32·06
Steep Island	122 36	30 12	6	5·90	9·81	11·46	11·05	38·22
Ningpo	121 44	29 58	6	11·55	15·10	24·43	17·18	68·26
4. *Coast from Wenchow to Swatow* :—								
Wenchow	120 35	28 0	6	7·67	18·56	30·24	10·97	67·44
Foochow	119 38	26 8	7	6·85	17·42	16·47	8·04	48·78
Middle Dog	120 2	25 58	7	6·83	16·71	15·31	7·69	46·54
Turnabout	119 59	25 26	5	6·23	15·39	17·85	7·48	46·95
Ockseu	119 28	24 59	6	4·41	11·23	14·88	3·88	34·40
Amoy	118 4	24 27	7	6·68	15·28	18·57	6·08	46·61
Chapel Island	118 13	24 10	6	5·86	13·91	12·05	5·61	37·43
Fisher Island	119 28	23 33	7	6·75	12·18	22·43	4·09	45·45
Lamocks	117 18	23 15	7	4·14	14 14	19·99	5·51	43·78
Swatow	116 43	23 20	7	5·88	18·41	27·18	7·49	58·96
Breaker Point	116 28	22 56	7	4·85	18·03	28·93	9·22	61·03
5. *Canton and Hainan* :—								
Canton	113 17	23 7	6	4·52	24·93	27·26	8·91	65·62
Pakhoi	109 6	21 29	7	6·10	13·41	33·67	9·73	62·91
Kiungchow (Hainan)	110 20	20 3	7	4·63	14·20	20·32	15·28	54·43
6. *Formosa* :—								
Keelung	121 45	25 8	7	46·48	33·98	24·65	43·25	148·36
Tamsui	121 25	25 10	7	16·93	21·86	19·10	22·07	79·96
Anping	120 13	22 59	6	2·33	14·95	41·67	5·53	64·48
Takow	120 16	22 36	6	0·86	12·50	39·52	8·73	61·61
South Cape	120 51	21 55	7	6·15	11·94	45·45	24·23	87·77

[It may be convenient to append the following values for the same district as given in Loomis's "*Contributions*" :—

Stations.	Long. E.	Lat. N.	Years.	Average Rain. in.
	° ′	° ′		
Pekin	116 29	39 57	33	24·56
,, Tsien Tsin	117 10	38 17	4	21·77
Shanghai	121 16	31 19	—	43·35
Zikawei	121 26	31 13	8	42·44
Kelung	121 46	25 20	2	120·08
Canton	113 16	23 15	—	77·64
Hong Kong	114 13	22 20	12	84·45
Macao	113 32	22 10	14	69·10
Hanoi Tonkin	105 48	21 2	1	70·91
Bangkok	100 30	11 45	10	58·55
Saigon	106 45	10 47	7	82·96

[Ed.

ROYAL METEOROLOGICAL SOCIETY.

The Monthly Meeting of this Society was held on Wednesday evening, May 15th, at the Surveyors' Institution, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. G. J. Symons, F.R.S., and Mr. G. Chatterton, M.Inst C.E., read a paper on "The November Floods of 1894 in the Thames Valley," which they had prepared at the request of the Council of the Society. This consisted of a systematic description of the causes which led to the great floods of November last, and an analysis of the records obtained from the Thames Conservancy Board, from the engineers of several of the towns along the river, and also from rainfall observers throughout the Thames watershed. The information was given chiefly in the form of tables, one of the first being a chronological history of floods in the Thames Valley from the year A.D. 9 down to the present time. This was followed by a short description of the damage wrought in November, 1894, which was illustrated by a number of interesting lantern slides. Details were then given of the levels reached at various places in all the principal floods from 1750 to the present time. The authors exhibited a map showing the relative elevation of all the parts of the Thames Basin, and then gave details of the rainfall for each day from October 23rd to November 18th, 1894. The results obtained by the Thames Conservancy Board, showing the flood-levels at each lock, were exhibited on a longitudinal section from Lechlade to Teddington, and the hydraulic inclinations from lock to lock were shown in a tabular form. The volume of flood-water, as gauged by the Thames Conservancy at Teddington, rose rapidly from 4,000 million gallons per diem on November 12th, to 10,250 million gallons on the 16th, to 12,800 million gallons on the 17th, and to over 20,000 million gallons on the 18th, when the discharge reached its maximum. The last-named discharge is equivalent to 0·37 inch over the whole watershed of the Thames above Teddington Lock.

Mr. F. J. Brodie read a short paper "On the Barometrical

Changes preceding and accompanying the heavy Rainfall of November, 1894," from which it appeared that the latter half of October was characterised by unusually bad weather, especially in the more western and southern parts of the British Isles. The rains of November 11th to 14th, which actually caused the floods, were due to two secondary depressions which developed a certain amount of intensity as they passed over the southern part of England.

As the two papers dealt with two branches of one subject, the discussion on both was taken together.

Mr. Baldwin Latham thought that the paper proved that floods on the Thames were not larger than in old times, which showed that the statement so often heard that floods were increased by agricultural drainage was fallacious.

Mr. Peregrine Birch added his protest against the opinion that land drainage increased the floods, and suggested that the idea arose from the increase of buildings, the waters which now invaded dwellings being unnoticed in the times when they simply spread over meadows.

Mr. Chatterton said that he had been unable to ascertain the levels of the bed of the river, and spoke on the variations between the mean hydraulic gradient, and the actual level, of the floods. The water appears to be held up for a time in ditches, drains, &c., by slight obstructions till it reaches sufficient volume to carry away the obstructions and comes down with a run, causing a very rapid rise in the river.

Mr. R. F. Grantham did not agree with Mr. Latham and Mr. Birch that the floods were not increased by drainage, but the Thames had been greatly improved, and the water was passed down the river much more rapidly.

The Rev. J. Slatter thought that the Thames Conservancy might mitigate the floods by running the river down after heavy rain. At Whitchurch he had noticed that the rise of the river occurred 36 hours after the rain fell; the floods in recent years had not lasted one quarter of the time that they used to, owing to the improvements effected on the river.

The President, Mr. Scott, Mr. Burstall, Major Lamorock Flower, Captain Wilson Barker and Dr. Buchan also took part in the discussion.

Mr. Symons, in reply, said that the influence of drainage on floods is not ascertainable without precise information as to each individual flood, variations in the cause producing varying effects. He had pleaded for flood marks for 30 years, and could not understand the indifference of public bodies to their erection.

A paper by the Rev. F. W. Stow entitled "A Natural Thermometer" was also read, in which the author inferred the existence of a marked local difference of temperature from observations of the effects of the frosts of May 1894 on chestnut and ash trees near Bishopsdale, Yorkshire.

A *FIN DE SIÈCLE* PROJECT.

[WE do not regard the proposal dealt with in the following article —and which we believe has been rejected—quite so contemptuously as do our Belgian friends, but their criticism is so interesting and instructive that we translate it *in extenso* from *Ciel et Terre* —ED.]

The whole daily press has recently teemed with details respecting the magnificent project submitted by M. Paschal Grousset to the Director General of the Paris Exhibition of 1900, and destined, in the opinion of the author, to be the feature of the Exhibition.

M. Grousset requests authority to proceed with an experiment tending to clear up one of the most interesting subjects connected with terrestrial physics—that of the existence of a central fire. It is desired to ascertain whether beneath the crust of the earth there is a nucleus in a state of fusion, or any other source of heat accessible to man and forming a store of force, of light, and of motion. Or does a vast liquid ocean exist beneath our feet?

One may well be astonished, says M. Grousset, that man has never attempted to study a problem of such importance, and on the whole so easy, but in ordinary circumstances the costs of the attempt would be too great in proportion to the benefit immediately obtainable.

And this is how M. Grousset proposes to realise the magnificent project of which he is so fond, and to solve the important problem which has, for so many years, divided the physicists and geologists.

To dig horizontal galleries at successive depths of each 200 metres (say 650 feet), uniting them by a series of vertical shafts, and going downwards until an unbearably high temperature is reached, if the law of increase of temperature be confirmed.

We will not describe in detail the attractions which M. Grousset proposes to offer to visitors to his subterranean galleries—they are to pass in succession from representations of the Arctic regions with ice and snow, then to temperate, and finally to representations of the tropics. Electric lighting, perfect ventilation and safety, everything [!] has been arranged for.

M. Paschal Grousset is perhaps a profound politician and a great statesman (he was a member of the Paris Commune), but he is unquestionably an indifferent *savant*, and his knowledge of the physical condition of the earth's crust is that of the last century.

Some years ago a Spanish or Mexican engineer (we forget which) tried to awake popular interest in an even wilder scheme, namely, to dig a hole right through the centre of the globe!

One of our most distinguished bibliophiles, very learned in many things, who was equally haunted by the question of a central fire, imagined another mode of solving the problem, by selecting a very lofty and isolated volcano and at its base excavating a horizontal gallery abutting on the central region of the mountain.

M. Grousset would be satisfied with going down 1,500 metres

(nearly a mile), but to do that there is no need to sink at Paris horizontal galleries connected by vertical shafts—of which the cost is put at 15 million francs (say £600,000).

The Belgian mine of Viviers-Réunis (Gilly) has a depth of about 1,100 metres (¾mile) and many others are between 800 and 1,000 metres.

At the well of Sperenberg, 40 kilomètres (24 miles) South of Berlin, the greatest depth is 1,390 metres (0·8 mile) and at Schledebach, also in Germany, the depth of 1,910 metres (1·2 miles) has been reached. Lastly, at Wheeling, in Western Virginia, a bore hole goes down to 1,500 metres.

When the Mont Cenis tunnel was being pierced, part of it was 1,654 metres (1 mile) below the summit, the summit of the St. Gothard is 1,706 metres (1·1 miles) above the rails, and those in the Simplon will be 2,135 metres (1·3 miles) below the summit.

M. Grousset does not appear to have any idea of the temperatures already ascertained at the great depths which we have above quoted.

In the Belgian coal mine of Poirier, although only 940 metres (0·6 mile) deep, the temperature in badly ventilated portions is 28° or 29° C. (82° to 84° F.), and in *culs-de-sac* it reaches 32° or 33° C. (90° to 91° F.).

At Sperenberg 49° C. (120° F.) and at Schledebach 57·5° C. (135·5° F.) has been observed.

At Wheeling, where the observations were made as a scientific investigation lasting over a whole year, the bottom temperature was 43°·5 C. (110°·3 F.), although at the surface it was only 10°·5 C. (51° F.) The increase of temperature became more rapid the deeper the boring was carried; for the whole depth it averaged 1° C. in 40 metres (1° F. for 72 feet), but near the bottom it was 1° C. for 30 metres (1° F. for 54 feet).

During the construction of the St. Gothard tunnel 30°·8 C. (87°·4 F.) was recorded. In the Simplon tunnel it has been computed that a temperature of 47°·5 C. (117°·5 F.) will be reached, and that for 10 kilometres (6 miles) it will be at least 40° C. (104° F.). The constructors will reduce this excessive temperature by powerful ventilation and by the production of water spray under high pressure and infinitessimally fine.

The foregoing statements show that the temperature at the depth of 1,500 metres (4,875 feet) is already known. The realisation of M. Grousset's project would therefore teach us nothing.

Finally (and this is an important detail), has M. Grousset estimated the cost of cartage and dumping of the millions of cube metres of earth which will have to be raised from the various shafts and galleries? No such item appears in the estimates.

So far *Ciel et Terre*. We do not say that its criticism is not well founded, but this proposal like most, may be regarded from two points of view.

When the Eiffel Tower was proposed, much ridicule was heaped upon the suggestion, and yet to this hour instruments on its topmost platform are automatically recording facts in the *Bureau Météorologique* which, like those already obtained, will doubtless be worked up by French *savants* and published by M. Mascart—sufficient proof of their utility.

So with M. Grousset's project. It is perfectly true that deeper borings and mines have been sunk, but almost always with a commercial object, and nothing approaching to a physical or magnetical observatory has ever been established at a great depth. Why should less be learned at 1,500 metres below the ground than at 300 metres (1,000 feet) above it? Earth Tremors, the transit of earthquake shocks, the flexure of the Earth's crust, variations in the force of gravity, in fact a multitude of problems occur to us which a deep-seated observatory free from the vibration of machinery, of blasting and of mining work could pursue.

Lastly, we are certain that to the general public the law of increase of temperature with depth is unknown, and we can see no harm, but rather the contrary, in the general diffusion of knowledge upon the subject.

EARTH TEMPERATURE AND WATER PIPES.

[We wish to ascertain the truth, and care relatively nothing as to whether suggestions made by ourselves are accepted or rejected. We see no advantage in printing letters which accept the suggestions which we offered; but, on the other hand, we wish to put our readers in possession of all that we have received, or seen, in criticism of our position, and these are the only two. The Rev. J. Slatter's letter really confirms our theory. The well water would not be "ice-cold water"—not like the Thames water which we see had, after storage, a temperature of 32°·9.—ED.].

WATER PIPES.

To the Editor of the Meteorological Magazine.

SIR,—There is one cause of injury to the water-pipes by frost which has escaped you—but which by my own cursory observations I am convinced has had as much to do with it as any you have enumerated—I mean careless laying of the pipes; so that continuity of the soil which was filled in was not preserved. My own pump draws from the well by about 35 feet of pipe laid horizontally, not more than 15 inches below the surface, and with a northern exposure; yet I suffered no inconvenience from frost. I attribute my immunity to the pipe being laid in ashes, which substance is not a good conductor, and being homogeneous and fitting close shut out the cold air completely.

Yours faithfully,

JOHN SLATTER.

Whitchurch, Oxon, 23rd May, 1895.

HATFIELD WATER WORKS.

SIR,—Regarding your remarks in the *Meteorological Magazine* (pp. 58 and 59) as to the temperature of the water of this well, viz. 51°, ameliorating the condition of mains from being frozen, this may be so, under certain conditions, to a greater or less degree. But the depth of the mains is a most essential factor in preserving them from frost, even when the water is pumped at the temperature as above. That this is so is proven by the circumstances of the water mains of St. Albans and Watford, both in this district, which were frozen to such a degree during the late frost as to almost deprive for several weeks these towns of water, and that the Engineers of these respective water works inform me that the water from their wells, as pumped, is of a temperature of from 50° to 51°. In both towns the water is pumped into covered reservoirs. Hatfield mains would have been frozen this last winter just as so many other mains were, but that they were laid to the depth described in my letter on p. 58.

Another circumstance that deprives the temperature index of almost any significance in the case of these works is, that the supply of water is so great in relation to its consumption, that pumping for 15 hours suffices for the week's constant service of 168 hours. The former number of hours is but 9 per cent. of the latter. Consequently the water in the open reservoir, which has a week's supply capacity, was nearly all the winter as cold as ice, as long as the frost continued.

Yours sincerely,

H. M. MILLER.

Hatfield, Herts, May 31st, 1895.

PHOTOGRAPHING METEORS.

IN *Ciel et Terre*, for April 16th, details are given of attempts made in the United States in 1893 to photograph members of several shooting star groups, and they were sufficiently successful to induce us to bring the suggestion before our readers, so that those interested in photography may try a new object. At Yale Observatory the camera was put upon an equatorial mounting and directed towards the radiant point, the total exposure was four hours, and three traces were found on the plate—one very good. On the same evening an ordinary camera, fixed at a window at Ansonia, caught the same meteor, and from the two traces the details of the meteor's path have been computed. The notice concludes with the following remarks:—

"Experience shows that with perseverance records of the path of meteors can be obtained. The exactitude of the results obtained is incomparably greater than can be obtained by any other method."

REVIEWS.

Les Aurores Polaires, par ALFRED ANGOT, Météorologiste titulaire au Bureau central météorologique de France. F. Alcan, Paris, 1895. 8vo., vii.–318 pages, 18 engravings or plates.

M. ANGOT calls attention to the long interval (more than a century) between the appearance of de Mairan's *Traité physique et historique de l'aurore boréale* (1733), and the next important work, Bravais' contributions, published in the Voyages of the "Commission Scientifique du Nord," and to the fact that during the subsequent half century no special work upon the subject has appeared in French. We do not quite understand this, and had perhaps better quote verbatim, first from M. Angot's preface, "Depuis cette époque [1840? the publication of Bravais's work] aucun travail d'ensemble n'a paru sur cette question dans notre pays."

Either M. Angot's memory failed him, or else this is a severe hit at Prof. Lemström's *L'Aurore boréale*, published in Paris in 1886, and the Avant-propos of which finishes with these words, "Nous sommes heureux de pouvoir réproduire à la fin de cet ouvrage neuf dessins d'aurores boréales, qui ont éte gravés d'apres les documents fournis par M. Angot, météorologiste titulaire au Bureau central météorologique de France."

As regards the plates, those in Prof. Lemström's book are certainly better than those in M. Angot's.

However, we forsake comparisons and confine our attention to the work before us, which certainly has several merits. The subject is treated systematically, thoroughly, judiciously, and clearly; these are strong words, but we believe that each is absolutely true. It is not often that we can forgive an author who issues a book without an index, but M. Angot's arrangement of chapters and sections is so extremely good that the table of contents answers almost every purpose which an index would. For example, Chapter III., "The Physical Characteristics of Auroræ," has the following sections:—Colour, Intensity of the Light, Nature of the Light, Noise, Odour; or again, Chapter V., "Periodicity of Auroræ": Daily Period, Annual Period, Secular Period, Relation to Sun-spot Periodicity. Classification like this renders it easy to ascertain with great rapidity not merely M. Angot's opinion on any point, but what the most recent and competent investigators have said; because, as we have already mentioned, M. Angot seems to us to have written not merely a well-arranged book, but one which is very fair and judicial in the way it discusses statements, and which is very easy and pleasant to read.

As regards the sound of Auroræ, M. Angot evidently feels that the evidence is very weak, but he leaves the suggestion open for further investigation, but the evidence for Auroræ producing a smell either like ozone or of any other kind, he considers too unsatisfactory to be accepted.

One feature has struck us on looking through this book, and we

mention it without for a moment asserting that there is anything in it. In recent photographs of lightning strokes, they have not infrequently appeared as gauzy ribbons. Some of the "curtain" patterns of aurora are by no means dissimilar in appearance.

We ought to give a short extract typical of the general style of the book, but it is all interesting, and therefore selection is difficult. The Section, "On the relations between the Clouds and Auroræ," is very good, but we have room for the conclusion only, viz. :—

"To sum up, there exist indisputable relations between clouds of the cirrus type and auroræ; the two phenomena present the same laws of periodicity, they are successive and sometimes co-existent, and their analogy is often such that many observers do not hesitate to affirm that the production of aurora is dependent upon the presence of cirri. We shall see later on that these views have very important bearings upon the theory of the aurora."

We can conclude by strongly recommending the book to the attention of our readers.

Dorset Annual Rainfall, 1848-92, by HENRY STORKS EATON, M.A. Past President of the Roy. Meteor. Soc. 8vo, Dorchester, 1895 (Excerpt Proc. Dorset Nat. Hist. and Antiq. Field Club), 30 pp., 2 coloured plates.

Mr. Storks Eaton has long been known as one of the best amateur meteorologists in the country. More than 30 years ago (in 1861) he contributed to the British (now the Royal) Meteorological Society a paper "On the fall of rain in Devonshire" which was far in advance of anything of the class, which had up to that time been done either for any part of England or of the world. In intervening years he has dealt with temperature, pressure, and other subjects, and now in the short paper under notice he gives an epitome of the rainfall of his native county which is almost as perfect as we can imagine, and as the observations permit. He has collected records from 75 stations in the county, and from 37 in the adjoining counties of Hants, Devon, Somerset and Wilts, the aggregate number of years dealt with being 670 in Dorset and 376 in the adjoining counties. The totals are printed *in extenso* so that they are available for anyone, but Mr. Eaton has worked out the true mean for each station with great care, computing them by differentiation from four stations and then adopting the mean of the four values. Mr. Eaton has, we believe, visited the majority of the existing stations so as to become conversant with the position and details of each, and gives in his paper a large map showing by shading the altitude above sea level of the whole county, while facing it is another on the same scale (4 miles to 1 inch, about $\frac{1}{253440}$) showing the rainfall by small figures over the sites of the observations, and also by blue shading, which naturally takes much the same configuration as the shading repre-

senting altitude. It is with this map alone that we should have preferred an alteration, or to speak correctly an addition. We do not understand why the author did not put on isohyetal lines for 30, 35 and 40 inches of rainfall. We have drawn them on our own copy and think that they tend greatly to emphasise the facts observed. The mean rainfall varies from rather below 30 inches near Weymouth, and Swanage, and in the extreme N.W., to nearly 50 inches on the hills in the centre; where, for the information of water engineers, we may mention that there is a ridge nearly 20 miles by 4 miles—say of 80 square miles with a mean rainfall of more than 40 inches. If we took it at 44 inches this would give a daily supply of 40,000,000 gallons a day, sufficient for say two million persons.

The paper brings out many facts of interest and importance; we will quote two only. There has lately been a discussion as to whether in a long register the driest three consecutive years will have a rainfall less than the mean by $\frac{1}{6}$th or by $\frac{1}{7}$th—we prefer to express it thus: whether the mean ratio for the driest three consecutive years should be taken as 83·3 or 80·0—Mr. Eaton's table gives 78·7. The other discussion has been as to there being any justification for the statement that years ending with 4 are generally dry. The only such years in Mr. Eaton's table, and the ratios for these, are

Year.	Ratio.	
1854	62	
1864.....	71	Average, 79.
1874.....	95	
1884.....	89	

Therefore they were all dry, and on the average there was a deficiency of 21 per cent.

Mr. Eaton and the Dorset Nat. Hist. Club have to be thanked for, and congratulated upon, an excellent piece of work.

CORRIGENDUM.

To the Editor of the Meteorological Magazine.

Met. Mag., vol. xxx., p. 61, Foot note, *, line 11,
For "The wind was easterly,"
Read "The wind was westerly."

With every apology for the slip of the pen,

F. C.

[We thought so, and therefore put the ?.—ED.].

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	63·9		31·3	22	52·0	41·5	42·7	87	98·1	26·1	2·85	14	6·3
Malta	78·6	1	52·5	25	70·6	58·5	51·3	80	130·5	46·8	4·60	16	6·6
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	83·9	9	63·5	24	81·9	68·7	63·8	71	135·8	53·3	1·31	10	5·3
Calcutta	85·6	1	59·2	25	79·7	64·4	65·0	80	146·8	52·0	3·04	4	2·1
Bombay	89·0	22	68·1	30	86·2	71·4	66·9	67	138·3	59·7	·00	0	1·2
Ceylon, Colombo	91·0	29	71·3	24	85·7	74·1	72·1	81	153·0	65·0	14·63	20	6·5
Melbourne	105·7	27	41·5	14	73·5	52·1	49·5	67	152·1	34·0	·79	7	5·1
Adelaide	107·0	26	45·3	1	81·5	55·2	47·5	47	161·0	37·3	·23	3	3·2
Sydney	97·5	26	55·3	19	79·2	62·8	57·3	62	155·0	43·9	·68	7	3·6
Wellington	70·0	1	42·0	26	63·8	51·3	48·5	76	142·0	29·0	4·14	14	4·5
Auckland	73·0	3	48·0	14	67·2	54·0	53·7	80	140·0	46·0	5·66	17	5·3
Jamaica, Kingston	90·3	19	68·7	5	88·2	71·1	70·4	81	...	...	2·07	6	4·6
Grenada	84·8	10	70·0	27*a*	82·8	73·3	71·1	74	157·0	...	9·23	26	4·0
Trinidad	92·0	6	63·0	20*b*	86·4	70·7	71·1	81	167·0	63·0	7·28	20	...
Toronto	54·8	3	10·0	29	40·7	27·6	28·1	73	...	5·7	·61	23	7·3
New Brunswick, Fredericton	56·9	3	1·5	30	37·4	21·2	24·2	74	...	...	1·66	14	5·5
Manitoba, Winnipeg	43·8	1	—25·0	28	27·0	9·3	...	...	...	...	1·87	17	7·1
British Columbia, Esquimalt	56·6	8	29·7	16	48·5	40·7	43·3	94	...	...	6·88	25	8·2

a—and 29. *b*—and 22.

Erratum.—In August table on p. 32, London—Absolute min. should be 41°·3, not 63°·1.

REMARKS.

MALTA.—Adopted mean temp. (62°·8), 1°·3 above the average. Mean hourly velocity of wind 7·3 miles. Thunderstorms on 5 days, and lightning on 8 other days. Hail on 15th. Dew point temp. ranged between 64°·4 on the 1st and 46°·7 on the 3rd. At noon on the 30th, during a dead calm, several waterspouts were seen over the sea three or four miles N.E. and N.W. of this station. J. F. DOBSON.

Mauritius.—Mean temp. of air equal to, dew point 0°·3 below, and rainfall ·59 in. below, their respective averages. Mean hourly velocity of wind 11·2 miles, or 0·3 mile above average; extremes, 23·5 on 2nd and 12th and 1·7 on 5th; prevailing direction, E. by S. to E. by N. Thunder and lightning on 28th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 11 days and lightning was seen on two other days. D. G. MANTELL.

Melbourne.—The max. temp. in shade (105°·7 on 27th) is the highest recorded in November during 40 years. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5 above the average of 37 years. On four consecutive days (23rd to 26th) the max. shade temp exceeded 100°, a very unusual occurrence in November. Rainfall ·79 in. below average. C. TODD, F.R.S.

Sydney.—Mean temp. 4°·4 above, humidity 8 below, and rainfall 2·49 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—On the whole a wet month, with short intervals of fine weather. Prevailing N.W. winds, generally strong. Lightning on 13th. Mean temp. 1°·0 above, and rainfall 0·3 in. below, their respective averages. R. B. GORE.

Auckland.—Showery and variable during the month. Particularly heavy fall of rain on 17th, 3·15 in. falling in less than 12 hours. Barometric pressure and mean temp. close to the average of 27 years, rainfall 2·5 in. over the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 3·1 miles. In Kingston the weather was fine, with rainfall a little below the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·42 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	·56	XI.	Lake Vyrnwy	...
,,	Birchington, Thor	·70	,,	Corwen, Rhug	2·52
,,	Hailsham	·12	,,	Carnarvon, Cocksidia ...	·32
,,	Ryde, Thornbrough	·27	,,	I. of Man, Douglas	·26
,,	Emsworth, Redlands ...	·25	XII.	Stoneykirk, Ardwell Ho.	·41
,,	Alton, Ashdell.....	2·27	,,	New Galloway, Glenlee	·58
III.	Oxford, Magdalen Col...	·18	,,	Melrose, Abbey Gate ..	1·05
,,	Banbury, Bloxham	·49	XIII.	N. Esk Res. [Penicuick]	·90
,,	Northampton, Sedgebrook	·51	,,	Edinburgh, Blacket Pl..	1·42
,,	Alconbury	·47	XIV.	Glasgow, Queen's Park.	·20
,,	Wisbech, Bank House..	·89	XV.	Inverary, Newtown	1·17
IV.	Southend	·16	,,	Islay, Gruinart School..	·07
,,	Harlow, Sheering	1·09	XVI.	Dollar.....	·54
,,	Colchester, Lexden.....	·31	,,	Balquhidder, Stronvar..	1·00
,,	Rendlesham Hall	·35	,,	Ballinluig	·44
,,	Diss	·59	,,	Dalnaspidal H.R.S. ...	1·36
,,	Swaffham	1·11	XVII.	Keith H.R.S.	·79
V.	Salisbury, Alderbury...	·22	,,	Forres H.R.S.	1·10
,,	Bishop's Cannings	1·08	XVIII.	Fearn, Lower Pitkerrie.	·52
,,	Blandford, Whatcombe.	·24	,,	Loch Shiel, Glenaladale	2·60
,,	Ashburton, Holne Vic....	1·59	,,	N. Uist. Loch Maddy ...	1·77
,,	Okehampton, Oaklands.	·60	,,	Invergarry	1·03
,,	Hartland Abbey	·61	,,	Aviemore H.R.S.	1·49
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,,	Wellington, Sunnyside..	·65	,,	Scourie	1·24
,,	Wincanton, Stowell Rec.	·41	,,	Watten H.R.S.	·43
VI.	Clifton, Pembroke Road	1·01	XX.	Dunmanway, Coolkelure	1·60
,,	Ross, The Graig	·43	,,	Fermoy, Gas Works ...	·70
,,	Wem, Clive Vicarage ...	1·01	,,	Killarney, Woodlawn ...	·94
,,	Cheadle, The Heath Ho.	·58	,,	Caher, Duneske	1·02
,,	Worcester, Diglis Lock	...	,,	Ballingarry, Hazelfort...	·99
,,	Coventry, Coundon	·77	,,	Limerick, Kilcornan ...	·86
VII.	Ketton Hall [Stamford]	·64	,,	Ennis	1·03
,,	Grantham, Stainby	·60	,,	Miltown Malbay.....	1·17
,,	Horncastle, Bucknall ...	·89	XXI.	Gorey, Courtown House	·15
,,	Worksop, Hodsck Priory	1·89	,,	Athlone, Twyford	·41
VIII.	Neston, Hinderton	·39	,,	Mullingar, Belvedere...	·15
,,	Preston, Haighton	...	,,	Longford, Currygrane...	·51
,,	Broughton-in-Furness..	·71	XXII.	Woodlawn.....	·96
IX.	Ripon, Mickley	·53	,,	Crossmolina, Enniscoe..	2·17
,,	Melmerby. Baldersby ...	·70	,,	Collooney, Markree Obs.	1·30
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	·90
,,	Middleton, Mickleton..	·89	XXIII.	Lough Sheelin, Arley ..	·41
X.	Haltwhistle, Unthank..	·47	,,	Warrenpoint	·19
,,	Bamburgh.....	·55	,,	Seaforde	·21
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	·31
XI.	Llanfrechfa Grange	·34	,,	Bushmills, Dundarave...	·93
,,	Llandovery	·63	,,	Stewartstown	·69
,,	Castle Malgwyn	·26	,,	Buncrana	1·23
,,	Builth, Abergwessin Vic.	·91	,,	LoughSwilly, Carrablagh	1·10
,,	Rhayader, Nantgwillt..	·97			

MAY, 1895.

STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which ·01 or more fell.	TEMPERATURE			
	Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours			Max.		Min.	
			Dpth	Date		Deg.	Date	Deg.	
	inches.	inches.	in.						
London (Camden Square) ...	·34	— 1·56	·12	17	5	86·2	30	35·7	
Maidstone (Hunton Court)...	·17	— 1·21	·10	17	3	...	...	...	
Strathfield Turgiss	·60	— 1·27	·28	23	8	85·1	30	31·5	
Hitchin	·70	— 1·25	·25	17*d*	6	82·0	30	35·0	
Winslow (Addington)	·50	— 1·60	·18	17	6	84·0	30	33·0	2
Bury St. Edmunds (Westley)	·88	— ·37	·39	17	9	76·0	30	34·0	
Norwich (Brundall)	1·09	..	·35	17	9	80·0	30	36·2	
Weymouth(LangtonHerring)	·31	— 1·30	·20	31	3	71·0	30	38·0	
Torquay (Cary Green)	·66	..	·38	31	3	73·7	14	39·0	
Polapit Tamar [Launceston]..	·33	— 1·50	·19	31	5	77·0	30	31·0	
Stroud (Upfield)	·48	— 1·56	·21	24	6	81·0	30	37·0	
ChurchStretton(Woolstaston)	·78	— 2·09	·49	1	8	78·0	30	34·0	
Tenbury (Orleton)	·61	— 1·34	·32	1	9	82·1	30	32·5	
Leicester (Barkby)	·63	— 1·34	·25	1	4	86·5	30	29·0	
Boston	1·87	+ ·15	·76	31	8	88·0	29*c*	31·0	
Hesley Hall [Tickhill].....	1·15	— ·39	·60	24	8	84·0	30	35·0	
Manchester(PlymouthGrove)	·59	— 1·76	·32	1	8	85·0	30	34·0	
Wetherby (Ribston Hall) ..	·04	— 1·91	·04	11	1	...	...	...	
Skipton (Arncliffe)	·86	— 2·36	·38	25	8	...	...	...	
Hull (PearsonPark)	·64	— 1·24	·27	1	8	...	...	...	
Newcastle (Town Moor)	·68	— 1·07	·18	19	11	...	...	...	
Borrowdale (Seathwaite).....	·58	— 8·03	·25	24	9	...	...	...	
Cardiff (Ely).....	·48	— 2·37	·39	31	2	..	...	...	
Haverfordwest	·09	— 2·27	·05	31	5	77·6	30	34·4	
Aberystwith (Gogerddan) ...	·43	...	·15	24	3	85·0	30	...	
Llandudno.....	·42	— 1·51	·17	24	6	81·5	30	41·4	
Cargen [Dumfries]	·06	— 2·46	·06	25	1	76·4	30	34·0	
Jedburgh (Sunnyside).....	1·22	— ·68	·52	24	11	75·0	29*c*	35·0	
Colmonell	·42	...	·22	24	2	80·0	30	33·0	
Lochgilphead (Kilmory)	·27	— 3·08	·16	25	5	...	...	31·0	
Mull (Quinish).....	·84	— 2·11	·41	14	10	...	...	...	
Loch Leven Sluices	·70	— 1·86	·20	31	6	...	...	...	
Dundee (Eastern Necropolis)	·55	— 1·11	·15	31	9	77·8	28	35·4	
Braemar	·55	— 1·86	·15	24	12	69·9	30	30·2	
Aberdeen (Cranford)	·69	...	·25	19	11	71·0	28*b*	33·0	
Strathconan [Beauly]	2·28	— ·81	·65	25	6	...	...	...	
Glencarron Lodge.....	3·45	...	·72	23	15	75·5	31	33·0	
Cawdor [Nairn]	1·74	— ·01	·37	22	14	...	...	...	
Dunrobin	1·10	— 1·00	·30	19	10	68·0	29	37·0	
S. Ronaldsay (Roeberry).....	·70	— 1·02	·33	12	6	66·0	27	36·0	
Darrynane Abbey.....	1·93	...	·56	31	13	...	...	...	
Waterford (Brook Lodge) ...	·61	— 1·62	·27	31	4	71·0	30	32·0	
O'Briensbridge (Ross)	·85	...	·36	22	7	..	...	...	
Carlow (Browne's Hill)	·54	— 1·80	·17	12*a*	5	...	..	...	
Dublin (FitzWilliam Square)	·18	— 1·75	·07	31	3	71·9	30	36·1	
Ballinasloe	1·30	— 1·39	·85	31	8	79·0	30	30·0	
Clifden (Kylemore)	·83	...	·17	11*b*	11	...	...	...	
Waringstown	·21	— 2·23	·16	12	3	81·0	30	33·0	
Londonderry (Creggan Res.).	·99	— 1·53	·29	24	10	...	...	...	
Omagh (Edenfel)	·74	— 1·73	·28	24	9	77·0	30	34·0	

a And 31. *b* And 29. *c* And 30. *d* And 23.

+Shows that the fall was above the average ; —that it was bel

METEOROLOGICAL NOTES ON MAY, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder: L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A very dry May, fine and bright, with plenty of sunshine, and warm until the 15th when a sudden fall of temp. occurred. Great heat on the 30th, followed by a TS at night. First swarm of bees on the 3rd; Swift first seen on 6th; horse chestnut in flower on 7th, Ox eye daisy on 17th, Laburnum on 19th. TSS on 23rd and 30th.

ADDINGTON.—A very fine month. R the least in May during the last quarter of a century, with the exception of 1871 when ·47 in. fell on 5 days. Max temp. the highest registered in May since 1871. A sharp TS on the night of the 30th with very vivid L but not much R.

BURY ST. EDMUNDS, WESTLEY.—A dry sunny month; temp. above the average until the 14th, then five days of cold north winds which injured the trees and hedges on the north side like exposure to fire; very hot from the 26th to the end of the month. R much wanted. T on the 12th, and distant T on the 23rd. H on 16th and 17th.

NORWICH, BRUNDALL.—Fine and warm to 14th; on the 16th a great fall in temp., the max being 72°·0 on the 14th, 58°·4 on 15th, and 44°·2 on 16th, on which day storms of H and sleet were frequent. The latter part of the month was again warm. In many parts of the county the results of the storm of the 16th were apparent to the end of the month, the north sides of the trees being covered with brown shrivelled leaves as in November, while on the south side the bright green May foliage was intact. L and T at night on 30th.

LANGTON HERRING.—There was an absolute drought of 29 days from 2nd to 29th inclusive. A fine warm month; mean temp. at 9 a.m. 56°·0, or 2°·1 above the average of 23 years. Fogs on the 13th, 14th, 24th, and 27th. TS on 30th. Hawthorn in blossom on 18th.

TORQUAY, CARY GREEN.—Rainfall 1·63 in. below the average. Mean temp. 54°·5, or 2°·7 above the average. Mean humidity 73. Duration of sunshine 298 hours 35 minutes, being 79 hours above the average; no sunless days.

POLAPIT TAMAR.—The driest May for 14 years. In addition to the drought the month was remarkable for the exceptional amount of sunny bright hot weather, and for the number of days on which there was very little wind. The average shade max. is 63°·9. There have been only three other months since January 1881 with less R.

STROUD, UPFIELD.—S and sleet fell on the hills on the 17th. T was heard on 22nd with H showers, and TSS occurred on 24th and 30th.

WOOLSTASTON.—An extremely dry month; the first and last parts were very hot, the middle part as cold, S falling lightly on the 17th. T with most vivid L for many hours on the 30th. Mean temp. 55°·1.

TENBURY, ORLETON.—The driest May for 47 years, and with the exception of May 1893 the warmest for 35 years, despite a week's cold weather from the 16th to the 22nd inclusive. The ther. reached 70° on 15 days and the maximum of 82°·1 on the 30th is the highest recorded in May since 1864. T on 23rd, 24th, 25th, and 30th. L on 25th and 30th.

LEICESTER, BARKBY.—A month of drought and changeable temp. First swift on 1st., first nightingale on 12th. L and T on the 9th without R, also on 30th with some R. Slight S on 20th.

MANCHESTER, PLYMOUTH GROVE.—The driest May experienced since observations commenced 29 years ago. The 30th was the hottest day in May for 29 years according to my record with the one exception of May 20th 1868, when the max temp in shade was 87°. A slight fall of S occurred in the early morning of the 17th, T and L on 24th, and T on the 30th. Mean temp. 55°·8.

WETHERBY, RIBSTON.—Hot sunshine daily; R much wanted.

WALES.

HAVERFORDWEST.—Excepting 1859—the year of great drought, when May was rainless—this is the least R in any May recorded. Great heat prevailed from the 7th to the 11th, succeeded by a sudden fall of temp. At night on the 15th it blew a gale stripping the fruit trees of their splendid bloom, and cold days and colder nights prevailed up to the 26th, when a warm period again set in. A great amount of bright sunshine and grass lands suffering much for the want of R. Wind generally N or N.E.

GOGGERDAN.—Very dry throughout the month, with bright sunshine. T and R in the neighbourhood.

SCOTLAND.

CARGEN.—Another record in 1895 has to be noted, after the coldest month ever experienced (February), we have had in May the driest month since observations commenced 36 years ago, R falling on only one day during a short T8. On no previous occasion has the R in any month been below ·10 in. Unless we have far more than the average for the next two months the water supply as far as it is dependent on springs and wells, is likely to become a serious consideration. The mean temp. for the month 53°·3 is 2°·6 above the average for May. In only three years since 1859 has a higher mean temp. been recorded, viz, 53°·7 in 1875, 54°·3 in 1889, 54°·5 in 1893. An unusually warm period prevailed during the last 11 days of the month, the mean temp. from 21st to 31st being 56°·5. The nights were generally very clear and cloudless, and radiation reduced the mean temp. below what might have been expected from the number of very warm days. Another feature was the high mean bar. 30·05 in., this pressure having been only twice exceeded in May since 1859. Vegetation unusually backward, and pastures and corn crops suffering for want of R.

JEDBURGH.—The early part of the month was, as usual, cold and ungenial, with low temp. and N.E. and E. winds. The last fortnight was mild, and vegetation progressed rapidly. All crops look well. T and L on 24th and 29th.

COLMONELL.—Rainfall 2·23 in. below the average of 19 years.

ROEBERRY.—Very dry, with a very cold week during the middle of the month. Mean temp. 49°·5.

IRELAND.

DARRYNANE ABBEY.—A fine and dry month and on the whole warm, but with a few cold days in the middle and at the end.

WATERFORD, BROOK LODGE. T and H showers on the 1st. Mean temp. 51°·9. Prevailing winds easterly.

O'BRIENSBRIDGE, ROSS.—A fine month with abundant sunshine, and the smallest R in May since 1861, when only ·51 in. fell. Cool in the evening from 15th to 21st. Great heat on 29th and 30th. Whitethorn bloom very scarce.

DUBLIN.—A beautiful month—bright and dry, without any severe night frosts. The amount of cloud was very low, only 3·7. Mean temp. 54°·3, 2°·3 above the average. Solar halos on the 3rd and 4th. Lunar halos on the 2nd, 3rd, and 9th, and an aurora on the 2nd. High winds on 3 days, attaining the force of a gale on 31st. T on 1st and 24th. H and sleet on the 1st. Slightly foggy on the 3rd and 4th.

WARINGSTOWN.—The driest May recorded.

EDENFEL.—Another month of deficient rainfall, making the total since 1st January, 9·65 in., the lowest for the like period in the 31 years during which the record here extends. Temp. above the average except during the third week, but as it did not then reach freezing point, the prospects of fruit are excellent, and the foliage is most luxuriant, but the drought is seriously affecting ordinary crops.

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The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy.)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

All communications should be addressed to the Editors of "The Observatory," Royal Observatory, Greenwich, S.E.

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SYMONS'S
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THE DRYNESS OF THE FIRST HALF OF 1895.

SEVERAL correspondents have sent notes calling attention to the fact that the first six months of this year have given a total rainfall smaller than even that of 1893.

Before writing anything upon the subject, we have tried to ascertain what departure from the average might be expected during the six months.

We have already shown that three consecutive dry years may have slightly less than four-fifths of the average; that two consecutive dry years may have only three-quarters of the average, and that one driest year may have rather less than two-thirds of the average; or, writing them as percentages—

Three consecutive years.	Two consecutive years.	One driest year.
78	74	63

We know also that a month may have no rain, when, of course, the percentage is 0. Plotting these values on a curve, it seems as if for six months the least total might be expected to be about half the average, or 50 per cent.

We have tested this by the Camden Square record, which now covers 37 consecutive years.

We may premise that on the mean of 37 years the fall for the first six months averages 11·40 inches, and for the second six months 14·48 inches, or 44 and 56 per cent. respectively of the *yearly* total.

The following are the six driest first six and driest last six months, and their percentages of the mean fall for the respective six months during the whole 37 years:—

Dry Six Months.

	Year.	Total Depth.	Per cent of Mean.		Year.	Total Depth.	Per cent. of Mean
		in.				in.	
JAN. to JUNE.	1870	6·90	60	JULY to DEC.	1863	10·62	73
	1874	6·93	61		1864	8·48	59
	1887	7·16	63		1874	11·89	82
	1892	8·12	71		1884	10·60	73
	1893	6·39	56		1887	12·05	83
	1895	5·48	48		1890	9·88	68

This seems to show not merely that on the average the first six months are drier than the second (as everyone knew before), but also that they are liable to greater deficiencies than the second six months. The average percentage for the six most remarkable dry periods of January to June is 60, but for the corresponding group for July to December it is 73.

Lastly—and this is the point which has led to the enquiry—January to June of 1895 comes out with a little less than half the average, and as absolutely the driest corresponding period for 37 years.

We will now give some data worked upon a shorter basis, so as to include a representative number of stations, and thus to ascertain the area over which the drought has been exceptional. We have taken stations of which we have the values for 1895 and for 1893, and the average for 1880–89; and finally, to keep the table within a reasonable size, we print only those values which show that the fall has in 1895 been less than 70 per cent. of the 1880-89 mean :—

Relation of the total rainfall in the first six months of 1893 *and* 1895 *to the average for the same period during* 1880–1889.

Station.	County.	Mean 1880-9.	1893.		1895.	
			Amount.	Per cent	Amount.	Per cent
		in.	in.		in.	
Camden Square.....	Middlesex ..	10·76	6·40	60	5·48*	51
Abinger Hall.....	Surrey	12·73	8·66	68	8·16	64
Chiselhurst	Kent	9·25	6·39	69	4·98	54
Tenterden	,, ...	10·95	9·69	89	6·83†	62
Crowborough.....	Sussex	13·82	9·43	68	7·99	58
Strathfield Turgiss ...	Hants	10·64	8·11	76	7·14	67
Fielde's Weir	Herts.....	10·79	5·74	53	5·01	47
Addington.....	Bucks	11·57	8·21	71	6·50	56
Magdalen College.....	Oxford	11·50	5·92	51	6·43	56
Sheering.....	Essex.....	9·88	6·37	64	5·54	56
Barkby	Leicester ...	11·70	7·05	60	7·96	68

* Driest in 37 years. † Driest in 32 years.

From this table it appears —

(1.) That our estimate that the fall of rain for a period of six months may fall to half the average is very near the truth.

(2.) That the district in which the deficiency in 1895 has been greatest is slightly to the N.E. of London.

This second conclusion is corroborated by the very remarkable figures contained in the following letter, for which we are indebted to Mr. Bryan. The Fielde's Weir figures are incorporated in the

above table; the others cannot be, because we have not the averages. The Buckhurst Hill total of 4·06 inches looks more like the summer value for the Riviera than the total for six months in "so called" rainy England.

To the Editor of the Meteorological Magazine.

SIR,—Herewith I beg to send you the rainfall for the six months ending 30th June at stations in the Valley of the Lea. You will observe that the rainfall is very low indeed.

Lea Bridge	4·26 in.
Ferry Lane, Walthamstow	4·49 ,,
Chingford Mill	4·83 ,,
Hagger Lane, Walthamstow	4·90 ,,
Buckhurst Hill	4·06 ,,
High Beech	4·66 ,,
Waltham Abbey	5·84 ,,
Feilde's Weir (junction of river Stort and river Lea)...	5·01 ,,

Yours truly,

WILLIAM B. BRYAN, M.I.C.E.

East London Waterworks Company, Lea Bridge, July 6th, 1895.

A *FIN DE SIÈCLE* PROJECT.

To the Editor of the Meteorological Magazine.

SIR,—Referring to the article on Grousset's proposal, in the *Meteorological Magazine* for this month, I think that you will find that the feasibility of the scheme is evident, from what has been done at Wieliczka salt-mines, a few miles from Cracow. I copy from "*The Angelus*" for May, 1895, published in Honduras. You may be able to verify the statement; if it is correct, the greatest depth is over two miles:—

"The system of mines extends over an area of 6 miles from east to west, and 2 miles from north to south, with underground streets, squares, &c., and over 30 miles of tramway; the greatest depth reached about 12,000 feet. At the depth of 300 feet is St. Anthony's chapel, hewn out of the salt rock. One of the caverns, called the *great hall*, contains lustres hanging from the roof, and all the curiosities, crystals, petrifactions, &c., which have been found in the mines. It is of amazing beauty, as the salt, according to its various qualities, is of different colours, greenish, dark-grey, yellow, &c. The annual output of salt exceeds 50,000 tons."—Yours faithfully,

R. STRACHAN.

11, *Offord Road, N., June 19th*, 1895.

[We were rather startled at the depth of "12,000 feet," as that ought to give a temperature of 281° F. The only work which we can find on our own shelves which gives a description of these wonderful mines is Klöden's *Handbuck der Erdkunde*, and it agrees with *The Angelus* in all respects except—as to the depth. Our Honduras contemporary has added a 0—1,200 feet is given by Klöden and is no doubt correct.—ED.]

A LOST OPPORTUNITY—RECORDING RAIN GAUGES.

We are sorry to use the above heading, but it seems the only appropriate one. We have heard much of the new Brussels Observatory at Uccle, and have often had to refer to the good work done by M. Lancaster. We suppose that either the Director, M. Folie, or perhaps a committee, is responsible for the instruments provided; but with whomsoever the responsibility rests, it is apparently the case that this observatory, upon which thousands of pounds have been spent, does not possess either a recording or a storm rain gauge. We can arrive at no other conclusion, from the fact that a great thunder and rain storm broke over the observatory about noon on June 10th, of which M. Lancaster gives a description in *Ciel et Terre*, but while his remarks give a vivid word picture of the storm, the actual numerical values are but two (and they are not absolutely consistent), and there is no information whatever as to the intensity of the fall during different parts of the 35 minutes.

The storm is stated to have begun at 5 minutes after noon, and to have lasted 35 minutes; that is to say, from 0·5 p.m. to 0·40 p.m., and the fall in 35 minutes is stated to have been 60 mm. (2·36 in.), but we are told also that the fall between 1 p.m. and 3.30 p.m. was 6 mm. (·24 in.), and that the total for the day was 66 mm. (2·60 in.). This implies that there was no rain between 0·40 p.m. and 1 p.m., but nothing in the text gives that idea.

The Brussels records extend back for half-a-century, no such fall has occurred before, but every meteorologist knows that such falls will occur sooner or later. It has come, and apparently found skilled observers with no better apparatus than that put up by Quetelet more than half-a-century ago.

Brussels observatory is not alone in this unpreparedness. Greenwich Observatory has no recording rain gauge, except the antiquated one put up among the chimney pots about 1840. So with the other public observatories; Cambridge has not one, nor Bidston, nor Edinburgh (but one may be ordered for the new observatory, we do not know), nor Dublin.

On the other hand, we believe that the following Meteorological stations are already provided with one or more:—

Div.	I.	Camden Sq. (Private)	
,,	I.	Hornsey Local Board	
,,	II.	Croydon (Private)	
,,	II.	Kew Observatory.	
,,	II.	Eastbourne (Private)	
,,	II.	,, Corporation	
,,	III.	Berkhamsted (Private)	
,,	III.	Oxford Observatory	
,,	IV.	Abbey Mills (London C.C.)	
,,	V.	Rousdon Observatory (Pvt.)	
,,	V.	Falmouth Observatory	
Div.	VI.	W. Bromwich Corporation	
,,	VII.	Leicester ,,	
,,	VIII.	Liverpool ,,	
,,	VIII.	Stonyhurst Observatory	
,,	VIII.	Lancaster Corporation	
,,	XIII.	Edinburgh (Private)	
,,	XIV.	Glasgow Observatory	
,,	XVII.	Aberdeen	
,,	XVIII.	Fort William	
,,	XX.	Valentia.	
,,	XXIII.	Armagh Observatory	

INDELIBLE DEGREE MARKS ON THERMOMETERS.

EVER since thermometers have been made accurately, and with the divisions engraved on the stems, there has been trouble from the black coming out of the said divisions, and when one realizes how extremely fine and shallow is the cut, in which the black has to be retained, the astonishment is, not at the fact that the black sometimes comes out, but that it ever stops in. As the result of much thought, this evil has, by the use of better materials, been largely mitigated. Some thermometers also, especially for use as "grass minima," are made on a plan which we suggested twenty years ago, and were told was impossible. We may as well mention what it was. About 50 years back, Mr. G. Leach, a very careful meteorological observer, had glass tubes made of about $\frac{1}{4}$-inch internal diameter, and long enough to contain the stem of a thermometer on which the divisions had been engraved and blackened; the bulb was left outside, and the tube was packed round with cork and other materials. These "Leach's shields" did partly protect the degree marks, but the joint was not air-tight, moisture condensed inside, and the divisions washed out. We suggested that the joint should be welded, and were told that unequal expansion would cause fracture—but it has been done.

Mr. Hicks, of Hatton Garden, has, however, hit upon a plan which seems to us perfect and everlasting. It seems so difficult to construct that an increased price would be necessary, but that is not the case, and if Mr. Hicks likes to supply the thermometers at the usual price, it is not for the public to complain.

We cannot expect a description alone to be sufficient, so give a view of a broken bit of the tube and a section of the same.

The process of construction apparently is—

(1) Prepare the thermometer stem with an enamel back and two bores, one of the usual size for the mercury or spirit,

and the other a large flattened bore behind to contain a strip of mica.

(2) Blow the bulb on the ordinary bore, fill with mercury or spirit, and seal that bore.

(3) Point off 32°, 52°, 72°, &c., on the front of the stem.

(4) Transfer these points to a prepared strip of mica, and divide and figure it as if it were the thermometer stem.

(5) Drop this scale into the large flattened bore, so that it agrees perfectly with the 32°, 52°, &c., marks.

(6) Weld the bore, and thus hermetically seal the scale in position.

The illustration shows a broken thermometer stem with part of the mica scale projecting. The section shows the thermometric bore for the mercury or spirit, and the flattened bore for containing the mica scale.

We have carefully examined both a sound and a broken thermometer made under this patent, and as far as we can see, there is no reason why it should not be as legible a thousand years hence as in the present year of 1895.

ROYAL METEOROLOGICAL SOCIETY.

THE last meeting of this Society for the present session, was held on Wednesday evening, June 19th, at the Surveyors' Institution, Westminster. Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. H. Curtis, F.R.Met.Soc., read a paper on the "Hourly Variation of Sunshine at Seven Stations in the British Isles." The paper is based on records of the Campbell-Stokes instruments for 10 years, 1881-1890. at Aberdeen, Glasgow, Armagh, Stonyhurst, Valencia, Kew, and Falmouth.

The results are dealt with in two ways: (1) A comparison of the actual duration, irrespective of the varying length of time that the sun is above the horizon at the different stations, and (2) The relation of the duration recorded, expressed as a percentage of the possible duration.

From the fact that there is a fairly close agreement between the means for the two 5 year periods, into which the 10 years have been divided, it may be inferred that the 10-year means approximate closely to the means which a longer period would yield.

Taking first the average daily duration, Falmouth is decidedly the most sunny station of the seven, having a daily average amount of sunshine of 4½ hours. This amount is half-an-hour more than that recorded at Valencia, and three-quarters-of-an-hour more than at Kew. Of the other four stations, Aberdeen, the most northern but at the same time a coast station, with 3·64 hours has more than either Stonyhurst or Armagh, both inland stations; whilst Glasgow with only 3 hours, or about a quarter of its possible amount, has the smallest record of the seven, a result to some extent due to the

nearness of the observatory to the large manufacturing works with which the City of Glasgow abounds. At Valencia, Kew, Stonyhurst and Armagh the maximum duration is reached in May, the daily mean amount varying in the order named from 6¾ to 6 hours. At Falmouth and the Scotch stations the increase goes on to June, when the mean duration at Falmouth reaches 7½ hours, at Aberdeen 6¼ hours, and at Glasgow 5·6 hours.

As might have been expected, January and December are the most sunless months of the year. At no station is there much difference between them, but the smallest mean daily duration of sunshine occurs in December at every station except Falmouth, where January is the least sunny month of the two.

Considering the distribution of sunshine throughout the day, the most prominent feature at all stations is the rapid increase in the mean hourly amount during the first few hours following sunrise and the even more rapid falling off again, just before sunset. This rapid increase in every month of the year covers two or three hours and the decrease rather less, the changes in the hourly amounts during the remainder of the day being of much smaller amplitude. This seems to be due rather to the greater extent of the lower atmosphere through which the sun's rays have to pass at those times than to greater cloudiness.

It is impossible in a short notice to describe the hourly variation but a few salient points may be mentioned. At Aberdeen, the different months show great similarity, and the most sunny hour is always at or close to noon; the hours following have a slight advantage over those preceding it.

At Glasgow, the greater amount of sunshine in the afternoon is well shown and, except in the winter, the max. occurs about 2 p.m.

At Armagh the sunniest part of the day occurs just before noon, but the variation is peculiar in several months, the max. in July occurring as early as 9 a.m.

The Stonyhurst maximum occurs at noon and 1 p.m., but varies in the different months from 11 a.m. in March and April, to 2 p.m. in July and August.

Valencia shows a fairly uniform course from sunrise to sunset, the max. occurring at noon.

At Kew, the increase and decrease in the hourly duration is very uniform, rising to 40 per cent. of the possible amount at noon and 1 p.m.

At Falmouth, the maximum is reached at 11 a.m. and is maintained till 2 p.m., the afternoon hours having rather more sun than the corresponding hours of the morning.

Mr. C. Harding thought that the smoke of the Glasgow factories mentioned in the paper is the cause of the defect of sunshine shown in the morning hours.

Mr. Bayard remarked on the flatness shown at the top of the curves of hourly variations, the lines being comparatively straight

from 10 a.m. to 3 p.m., also on the adjustment of the different patterns of instrument.

Mr. Dines suggested that the flatness of the curves is due to the fact that the instrument is a heat recorder and that, although slight obscuration would stop the record early or late, it would not do so when the altitude of the sun is considerable. He would like to see the records compared with those from photographic recorders.

Mr. Sowerby Wallis thought that, considering the effect of smoke at Glasgow and the slight interruption in the record at Armagh caused by the shadow of the anemometer, we should not at once assume that other anomalous results shown in the paper represented physical facts.

Mr. Tripp said that the Campbell instrument recorded the heat rays, the photographic the chemical rays, and asked whether there was any means of recording the light rays.

Mr. Symons believed that no other country in the world could produce such a series of records, and was proud to welcome the paper. The effect of smoke at Glasgow could not be denied, but Falmouth showed a similarity in the curve, though to a less extent. He thought the records were a function of the altitude of the sun, and would like to see the effect of this eliminated from the results.

The Hon. F. A. R. Russell would like to see the results compared with observations of direction of wind, amount of cloud and mist and haze.

Mr. Gaster said that the paper had proved the greater amount of sunshine at coast than at inland stations, but experiments were necessary as to the difference at hill and at valley stations. The direction of wind was important in relation to the effect of smoke, and a comparison of sunshine records at Kew and Greenwich showed this well.

Mr. Backhouse spoke on the daily variation of cloud as compared with sunshine.

Mr. Marriott referred to papers on the sunshine observations at Greenwich by Mr. Ellis, and at Kew by Mr. Whipple, described a method of testing the adjustment of the instrument, and spoke of the importance of height above ground.

The President spoke of the effect of wind, mist, rain, &c., on the trace burnt on the cards.

Mr. Curtis, in reply, said that the results should undoubtedly be studied not only with the physical characteristics of the station, but also with the other meteorological elements. He did not think that wind had any effect on the record, but while mist moderated the amount of burning, cloud stopped it altogether.

Mr. H. Harries, F.R.Met. Soc., read a paper on "The Frequency, Size and Distribution of Hail at Sea." The author had examined a large number of ships' logs, and gave extracts from them showing that hail has been observed in all latitudes, as far as ships go north

and south of the equator, and that seamen meet with it over wide belts on the polar side of the 35th parallel.

The Hon. F. A. R. Russell analysed the records showing that few of them described what would on land be called great hail storms, and that the majority were near shore or at least not in mid-ocean. The hour being late, the discussion was not continued.

HISTORY OF BRITISH EARTHQUAKES.

To the Editor of the Meteorological Magazine.

SIR,—Many notices of British earthquakes are to be found in the *Meteorological Magazine*, perhaps more frequently in the early than in recent numbers. The subject has indeed but little direct connection with meteorology, but the training provided by the accurate reading of delicate instruments and the careful observation of the weather is precisely that which is most essential to the seismologist.

With a view to aiding in the careful observation of earthquakes and to pointing out the details most worthy of attention, I have drawn up a short paper of suggestions, a copy of which by your kind permission is inserted in this number of the *Met. Mag.*

I would also take this opportunity of mentioning that I am preparing a history of the British earthquakes of the nineteenth century, and should be very grateful for any notices of past or future shocks which your readers may be so kind as to contribute, whether derived from newspapers, private diaries, or other trustworthy sources. That such a history should even approach completeness is of course out of the question; my aim must be to reduce, as far as possible, the imperfection of our seismic record.

Yours obediently,

CHARLES DAVISON.

373, *Gillott Road, Birmingham, June 17th*, 1895.

DO OVERHEAD WIRES WARD OFF LIGHTNING?

Have our cities been altogether wise in burying their electric wires? To answer this question, observations were first made in all the cities having telephone installations, and in a large number of places without such installations; and their result has been to demonstrate the fact that the network of telephone wires has diminished the violence of thunderstorms and lessened the danger from lightning. As the first statistics obtained were not free from objections, the observations were continued according to definitely limited rules. Thus there were examined 900 places, of which 340 had city telephone systems, and 560 had none. The results were favourable to the first; the ratio of injury to buildings in them to that in places without telephone systems was as 1 to 4·6. It may be objected that places without telephone systems are

usually smaller than those which possess them, and that experience has shown that danger from lightning is greater in the country than in the city. But this danger is at the greatest only about twice as large, while the above given ratio between towns with and without telephone systems shows the danger in the latter to be about five times greater. It seems to speak especially well for the protective powers of the telephone system that of a total of ninety-four buildings which were damaged by lightning in cities provided with such systems, there was only one which had a water-pipe connected with the lightning conductor. The wider problem also was investigated, whether the network of wires of the telephone system hinders or weakens the lightning discharge by gradually equalising the difference of electric potential which exists between the clouds and the earth's surface; and here the equally favourable result appeared that in the places with telephone systems an average of three lightning discharges struck the earth during each hour of storm, while in the places without telephone systems five bolts struck during the same time. The observations are not yet completed, but it should already be regarded as proved that the network of wires of a telephone system actually exerts a protecting influence against injury from atmospheric electricity.—[*Gaea* (*Leipsic*).]—*Public Opinion*, April 19th, 1895.

TELEPHONES AND THUNDERSTORMS.

Do overhead telephone wires exercise a controlling influence on the electricity of the atmosphere? That the converse occurs is evidenced only too plainly by the disturbances in telephonic communication which result from the presence or proximity of a thunderstorm. More than one instance may be recalled of a telephone wire being struck by lightning, to the detriment of the instrument and to the discomfiture of the listener. Such a case was commented upon in the *Lancet* of May 5th, 1894. But do overhead wires ward off lightning? We are indebted to the *Decorators' Gazette and Plumbers' and Gasfitters' Review* for the "fact" that the risk to buildings of being struck by lightning in places unprotected by overhead telephone wires is nearly five times greater than in places provided with a telephone system.* An immunity of this kind cannot be considered improbable. It is to be remembered that an overhead telephone wire becomes in point of fact a lightning conductor, and in this capacity may act in two ways: (1) by equalising differences of potential, it may prevent the occurrence of the disruptive discharge; or (2) receiving a lightning charge it may carry the current to earth. With reference to the first point there can be little doubt that overhead conductors, if connected to earth, do play an important part in the distribution of atmospheric electricity. Lord Kelvin in a recent paper (read before the Philosophical Society of Glasgow) states that the difference of potential he obtained between the earth, and an insulated burning match placed nine feet above the ground, was 200 to 4,000 volts. What, then, is the result of permanently connecting by a good conductor the

* We think that the *Lancet* is mistaken in giving the credit to the *Decorator's Gazette* (a copy of which we have been unable to obtain) as the resemblance to the preceding quotation from the *Gaea* seems to show that the *Decorator's Gazette* has simply reproduced its facts.

earth and the atmosphere directly above it, a condition which exists in the case of single-wire telephone circuits? Such an arrangement must tend to equalise potential and prevent the accumulation of those charged masses which no doubt form the nucleus of the storm cloud. This equalisation will continue to take place in all conditions of weather. But when a storm does occur, it is obvious that the wire if struck by lightning carries the current to the point of greatest danger—viz., to the instrument and to anyone in its vicinity. Therefore, unless the strictest structural precautions be taken, such a wire becomes a source of danger rather than of safety.

To obviate this danger, every post or support for overhead wires ought to be fitted with a lightning guard, and every instrument, whether using the earth as a return or not, should be fitted with an efficient form of lightning arrester. Where the overhead wires are not connected to earth, as is the case with overhead "lighting mains" and "twin" telephone circuits, any equalising effect upon potential difference is practically lost, and any circuit connected with overhead wires of this kind must be dangerous, inasmuch as such wires become lightning conductors in all but the saving device of an earth connection. For "lighting mains" it can scarcely be doubted that the underground system is in most respects the better: (1) for obvious reasons connected with the size of the cables; (2) for the electrical reason that if carried overhead no earth connection is allowable by the Rules of the Board of Trade. For telephones the adoption of the "twin wire" system seems to bring with it the advisability of placing the wires below the surface of the ground, inasmuch as this system does away with the earth return as part of the circuit. It therefore appears that from an electrical point of view there may be in overhead wires an element both of safety and of danger. The latter will certainly predominate unless supports be protected with lightning guards and every instrument provided with an efficient "protector"—that is, with an unfailing means of carrying a strong current to earth without passing through the instrument. Is this secured in practice? Can it be secured with any certainty by even the best lightning arrester or earthing device of any description? As long as the coarse expedient of a connecting wire is necessary for the guidance of electrical energy, so long must this question of "wiring," with its safeties and its dangers, be one of great and growing interest. But it may be pointed out that if every house were fitted with an efficient form of lightning guard, a greater immunity from lightning discharges would be secured than that which at present exists with the closest network of overhead telephone wires.—*Lancet*, May, 1895.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	52·1	17*a*	26·3	31	46·7	36·4	37·6	86	69·6	24·6	2·28	16	6·1
Malta	68·9	16	43·2	19	61·7	51·4	47·7	75	113·2	37·5	7·29	22	6·8
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	85·3	25	69·0	22	83·1	73·8	70·2	79	137·7	62·0	5·90	16	6·8
Calcutta	81·7	5	51·2	28	76·2	58·3	58·3	76	136·5	43·0	·03	1	2·2
Bombay	88·1	19	64·0	15	83·2	69·3	66·4	72	134·9	54·5	·01	1	1·0
Ceylon, Colombo	89·7	...	68·6	27	87·1	72·8	69·4	74	149·0	64·0	3·25	15	5·4
Melbourne	92·0	10	45·6	18	75·0	56·8	54·6	72	141·1	37·2	2·71	11	8·6
Adelaide	102·8	13	49·9	2	84·2	60·6	53·0	51	165·0	41·6	1·37	11	5·0
Sydney	90·7	15	56·2	3	76·6	64·9	59·4	65	156·2	46·7	3·03	19	5·7
Wellington	80·0	30	48·0	19*c*	70·1	55·9	53·8	72	144·0	34·0	·82	8	3·9
Auckland	79·0	27	56·0	12*d*	73·9	59·9	60·4	80	144·0	54·0	·20	4	4·3
Jamaica, Kingston	90·3	12	63·2	25	85·1	67·7	66·2	80	...	...	2·43	5	3·9
Grenada	86·4	24	70·2	12	82·3	72·9	70·8	73	159·0	...	7·84	24	2·8
Trinidad	90·0	20	68·0	*e*	86·9	69·8	70·5	81	169·0	66·0	3·16	14	...
Toronto	49·3	16	−5·0	28	37·2	25·6	25·3	79	...	−11·2	2·12	17	6·9
New Brunswick, Fredericton	46·9	17	−10·2	10	31·2	10·3	17·7	65	...	...	2·73	15	5·1
Manitoba, Winnipeg	37·4	19	−24·5	27	23·7	5·4	...	...	...	...	·55	10	4·9
British Columbia, Esquimalt	47·7	11	28·2	28	42·0	34·1	36·9	93	...	...	1·66	17	6·0

a—and 18. *b*—and 5. *c*—and 20, 28. *d*—and 14. *e*—Various.

REMARKS.

MALTA.—Adopted mean temp. (55°·8), 0°·5 below the average. Mean hourly velocity of wind 11·6 miles. Thunderstorms on 8 days, and lightning on 5 other days. Hail on 3 days. Dew point temp. ranged between 56°·6 on the 6th and 36°·0 on the 18th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·6 above, dew point 2°·2 above, and rainfall ·79 in. above, their respective averages. Mean hourly velocity of wind 12·0 miles, or 1·1 mile above the average; extremes, 30·3 on 17th and 0·0 on 3rd; prevailing direction, E.S.E. to E. by N. Thunder and lightning on 1st, 4th, 5th and 27th, and thunder on 7th and 13th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on the 1st, 2nd, 3rd, 5th and 6th, and lightning was seen on the 4th and 18th. D. G. MANTELL.

Adelaide.—Mean temp. 1°·4 above, and rainfall ·54 in. above, the average of 37 years. Weather generally hot, and general and heavy rains setting in after Christmas Day, especially heavy in pasture districts E. and N.E. of Lake Eyre. C. TODD, F.R.S.

Sydney.—Mean temp. 1°·1 above, humidity 4·7 below, and rainfall ·44 in. above, their respective averages. H C. RUSSELL, F.R.S.

Wellington.—Prevailing wind N.W. and strong in the early part of the month. Generally fine pleasant weather. Mean temp. 2°·2 above, and rainfall 3·12 in. below, their respective averages. R. B. GORE.

Auckland.—Remarkable for its extreme dryness, the total rain for the month being only ·20 in., the average of 27 years being 2·78 in. Mean temperature much above the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Generally fine. Northers from 16th to 20th and on 29th. Rainfall above the average. Mean hourly velocity of wind 3·7 miles. R. JOHNSTONE.

TRINIDAD.—Rainfall 1·65 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	·37	XI.	Lake Vyrnwy	1·31
,,	Birchington, Thor	·75	,,	Corwen, Rhug	·56
,,	Hailsham	·66	,,	Carnarvon, Cocksidia ...	·69
,,	Ryde, Thornbrough	·96	,,	I. of Man, Douglas	·91
,,	Emsworth, Redlands ...	·74	XII.	Stoneykirk, Ardwell Ho.	1·40
,,	Alton, Ashdell.....	·54	,,	New Galloway, Glenlee	·76
III.	Oxford, Magdalen Col...	·73	,,	Melrose, Abbey Gate	1·95
,,	Banbury, Bloxham	·88	XIII.	N. Esk Res. [Penicuick]	1 40
,,	Northampton, Sedgebrook	·61	,,	Edinburgh, Blacket Pl..	2·88
,,	Alconbury	·53	XIV.	Glasgow, Queen's Park.	1·68
,,	Wisbech, Bank House..	1·25	XV.	Inverary, Newtown	2·86
IV.	Southend	·19	,,	Islay, Gruinart School..	...
,,	Harlow, Sheering	·16	XVI.	Dollar.....	2·45
,,	Colchester, Lexden.....	·24	,,	Balquhidder, Stronvar.	2·42
,,	Rendlesham Hall	·36	,,	Ballinluig	1·72
,,	Diss	·55	,,	Dalnaspidal H.R.S. ...	2·57
,,	Swaffham	1·78	XVII.	Keith H.R.S.	5 25
V.	Salisbury, Alderbury...	1·37	,,	Forres H.R.S.	3·66
,,	Bishop's Cannings	·95	XVIII.	Fearn, Lower Pitkerrie.	3·51
,,	Blanford, Whatcombe.	1·40	,,	Loch Shiel, Glenaladale	...
,,	Ashburton, Holne Vic....	1·65	,,	N. Uist. Loch Maddy ...	2·56
,,	Okehampton, Oaklands.	1·10	,,	Invergarry	2·05
,,	Hartland Abbey	1·75	,,	Aviemore H.R.S.	2·73
,,	Lynmouth, Glenthorne.	1·19	,,	Loch Ness, Drumnadrochit	4·94
,,	Probus, Lamellyn	1·54	XIX.	Invershin	2·29
,,	Wellington, Sunnyside..	1·40	,,	Scourie	1·92
,,	Wincanton, Stowell Rec	1 00	,,	Watten H.R.S.	2·46
VI.	Clifton, Pembroke Road	·82	XX.	Dunmanway, Coolkelure	2·75
,,	Ross, The Graig	·93	,,	Fermoy, Gas Works ...	3·59
,,	Wem, Clive Vicarage ...	·89	,,	Killarney, Woodlawn ...	2·97
,,	Cheadle, The Heath Ho.	1·20	,,	Caher, Duneske	2·18
,,	Worcester, Diglis Lock	3 60	,,	Ballingarry, Hazelfort...	1·12
,,	Coventry, Coundon	1·23	,,	Limerick, Kilcornan ...	1·25
VII.	Ketton Hall [Stamford]	1·24	,,	Ennis.....	...
,,	Grantham, Stainby	·72	,,	Miltown Malbay.....	1·59
,,	Horncastle, Bucknall ...	1·68	XXI.	Gorey, Courtown House	3·35
,,	Worksop, Hodsock Priory	1·98	,,	Athlone, Twyford	·90
VIII.	Neston, Hinderton	1 63	,,	Mullingar, Belvedere ...	2·34
,,	Preston, Haighton	...	,,	Longford, Currygrane...	1·18
,,	Broughton-in-Furness..	1·59	XXII.	Woodlawn.....	1·17
IX.	Ripon, Mickley	3·22	,,	Crossmolina, Enniscoe..	1·39
,,	Melmerby Baldersby ...	3·49	,,	Collooney, Markree Obs.	1·62
,,	Scarborough, South Cliff	2·68	,,	Ballinamore, Lawderdale	1·32
,,	Middleton, Mickleton..	1·44	XXIII.	Lough Sheelin, Arley ..	1·69
X.	Haltwhistle, Unthank..	1·56	,,	Warrenpoint	2·33
,,	Bamburgh.....	1·51	,,	Seaforde	1·50
,,	Keswick, The Beeches...	1·01	,,	Belfast, Springfield	2·81
XI.	Llanfrechfa Grange	1·49	,,	Bushmills, Dundarave...	2·29
,,	Llandovery	·78	,,	Stewartstown	2·33
,,	Castle Malgwyn	·69	,,	Buncrana	2·23
,,	Builth, Abergwessin Vic.	1·23	,,	LoughSwilly, Carrablagh	2·73
,,	Rhayader, Nantgwillt..	1·00			

JUNE, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	·30	— 1·71	·20	18	4	83·9	23	42·2	1
II.		Maidstone (Hunton Court)...	·19	— 1·43	·15	30	5	...	...	...	
,,		Strathfield Turgiss	·66	— 1·14	·28	28	10	83·3	9	34·8	1
III.		Hitchin	...	...	...	...	...	...	...	...	
,,		Winslow (Addington)	·32	— 1·54	·18	28	5	80·0	26	35·0	1
IV.		Bury St. Edmunds (Westley)	·52	— 1·27	·10	1*a*	8	75·0	23	39·0	1
,,		Norwich (Brundall)	·85	...	·40	27	10	79·0	23	37·7	1
V.		Weymouth(LangtonHerring)	2·00	— ·23	1·03	28	9	77·0	8	44·0	1
,,		Torquay (Cary Green)	1·10	— ...	·50	28	8	77·0	8	43·0	1
,,		Polapit Tamar [Launceston]..	1·55	— ·66	·49	30	8	80·0	24	34·0	1
VI.		Stroud (Upfield)	·67	— 1·72	·25	29	8	83·0	25	46·0	1
,,		ChurchStretton(Woolstaston)	·73	— 1·82	·27	26	5	82 0	25	39·0	1
,,		Tenbury (Orleton)	·85	— 1·76	·56	1	7	83·0	25	33·2	1
VII.		Leicester (Barkby)	·71	— 1·64	·23	30	9	86 5	26	29·5	1
,,		Boston	1·17	— ·72	·34	26	7	90·0	26	35·0	1
,,		Hesley Hall [Tickhill].....	1·95	+ ·03	·65	26	10	86·0	26	34·0	1
VIII.		Manchester(PlymouthGrove)	3 05	+ ·40	·94	28	10	86·0	26	34·0	1
IX.		Wetherby (Ribston Hall) ..	2·17	+ ·28	·78	2*b*	6	...	...	...	
,,		Skipton (Arncliffe)	2·38	— ·98	·67	1	11	...	...	...	
,,		Hull (Pearson Park).	2·49	+ ·74	·87	26	9	79·0	26	34·0	1
X.		Newcastle (Town Moor)	3·04	+ 1·40	82	26	13	...	...	...	
,,		Borrowdale (Seathwaite).....	3·18	— 3·40	·77	1	10	...	...	...	
XI.	WALES.	Cardiff (Ely).....	1·63	— ·80	·39	1	9	..	...	...	
,,		Haverfordwest	1·23	— 1·33	·49	30	9	80·3	25	34·2	
,,		Aberystwith (Gogerddan) ...	·89	...	·30	29	6	80·0	7	...	
,,		Llandudno.....	·89	— ·88	·35	1	9	77·4	26	42·5	
XII.	SCOTLAND.	Cargen [Dumfries]	...	...	...	...	...	...	...	...	
,,		Jedburgh (Sunnyside).....	1·04	— ·70	·36	17*c*	10	82·0	25*d*	32·0	
XIV.		Colmonell	1·23	...	·28	28	7	83·0	25	32·0	
XV.		Lochgilphead (Kilmory)	2·00	— 1·10	·62	26	14	...	...	32·0	
,,		Mull (Quinish).....	·77	— 2·52	·28	17	13	...	...	...	
XVI.		Loch Leven Sluices	1·20	— ·55	·40	18	7	...	...	...	
,,		Dundee (Eastern Necropolis)	1·65	+ ·15	·60	17	11	78·9	8	36·3	
XVII.		Braemar	2·67	+ ·68	·87	18	15	77·4	7	34·4	
,,		Aberdeen (Cranford)	2 34	..	·70	17	14	74·0	22	35·0	
XVIII		Strathconan [Beauly]	5·71	+ 3·22	1·73	18	7	...	...	..	
,,		Glencarron Lodge.....	4·52	...	1 00	17	20	76·0	25	35·9	
,,		Cawdor [Nairn]	4·34	+ 2·94	1·11	17	18	...	...	..	
XIX.		Dunrobin	2·75	— ·73	·72	17	16	68·8	8	36·5	
,,		S. Ronaldsay (Roeberry).....	2·02	+ ·26	·31	3	18	67.0	6	40·0	
XX.	IRELAND.	Darrynane Abbey.....	1 81	...	·52	30	7	...	...	...	
,,		Waterford (Brook Lodge) ...	...	...	...	...	...	...	...	...	
,,		O'Briensbridge (Ross)	1·07	...	·36	27	6	..	...	...	
XXI.		Carlow (Browne's Hill)	2 85	+ 1·01	·78	30	9	...	..	...	
,,		Dublin (FitzWilliam Square)	1·87	+ ·21	·64	30	12	77·6	26	42·3	
XXII.		Ballinasloe	·97	— 1·33	·33	30	7	79·0	24	30 0	
,,		Clifden (Kylemore)	2·23	...	·60	30	13	...	...	...	
XXIII		Waringstown	1·76	— ·31	·40	3	12	85·0	25*d*	35·0	
,,		Londonderry (Creggan Res.).	2·08	— ·34	·31	20	18	...	...	...	
,,		Omagh (Edenfel)	1·21	— 1·26	·30	18	12	82·0	24	30·0	

a And 11, 18. *b* And 27. *c* And 28. *d* And 26. *e* And 13, 15.

+Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JUNE, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month opened with unsettled weather and cloudy, but soon became fine and very dry. TSS occurred around this station, but did not develop here. The end of the month was showery and unsettled. On the 13th, 15th, 16th and 17th there was frost upon the grass.

ADDINGTON.—The least R on record for the month of June. The fall of the first six months of the year, 6·50 in. on 63 days, is also, with the exception of 1892, when only 6·40 in. fell on 73 days, the least recorded. On the 26th a very sharp TS occurred one mile to the N. of us, but no R fell here. Again on the evening of the 29th heavy R fell in the same locality, but none here. On the morning of the 15th slight frost on grass occurred, enough to blacken potatoes in low situations.

BURY ST. EDMUNDS, WESTLEY.—A month of great drought; the R fell in such small quantities that it dried up in a very short time. We have suffered more than in 1893, and the agricultural look-out is very bad. On the 26th, a short distance from here, a good R fell, and the TS on that night was most grand.

NORWICH, BRUNDALL.—A very dry month and many warm days. Mean temp. about the average. R one inch below the average. T on 1st, 12th, 13th, and 20th; T and L on 14th and 27th; L on 26th.

LANGTON HERRING.—On the whole a fine, bright, sunny month, very favourable for securing the hay. Mean temp. at 9 a.m., 61°·4, which is 1°·1 above the average of 23 years. Fog on the 22nd, but no T or L. The average reading of the bar. was the highest in June in 14 years.

TORQUAY, CARY GREEN.—Rainfall 1·28 in. below the average; Mean temp. 59°·6, or 1°·8 above the average; duration of sunshine, 273 hours 5 min., being 40 hours 30 min. above the average; no sunless day.

POLAPIT TAMAR.—A very hot, dry and calm month. The average max. shade temp. for the month is as high as 68°·8. The total R for the first six months of 1895 is only 11·54 in., being 2·96 in. under the average.

STROUD, UPFIELD.—T from 11 a.m. to 6 p.m., and a few flashes of L, on the 26th; the storm came from the S. and went to the E. On the 29th a flash of L and heavy peal of T about 5 p.m.

WOOLSTASTON.—A very hot and dry month, R falling on five days only. A severe storm of T and L occurred on 26th. Mean temp. 58°·6.

TENBURY, ORLETON.—A very fine, hot, dry month, the hottest June since 1870, and with the exception of June, 1889, the driest in the same time. Mean temp. was 2°·8 above the average. Sharp frosts on five mornings, the one on the 15th doing considerable damage to potatoes, &c. Great TS all round on the 26th, but no R here; T and L also on 29th. Fog on 1st and 3rd.

LEICESTER, BARKBY.—A very dry month, hay crops deficient. Mean temp. 58°·6. T on 12th, 26th, 27th and 30th.

HESLEY HALL [TICKHILL].—Severe TSS on 26th and 27th, and heavy T on 30th.

MANCHESTER, PLYMOUTH GROVE.—Summer weather from 7th to 10th; from 11th to 17th cold and unsettled, the temp. on grass falling to 29° on 15th. Fine summer weather from 19th to 25th. On the 26th a violent TS, the L being very vivid and frequent; T and L also on 27th, with showers, and a violent TS, with torrents of R, on 28th; T and L again on 29th, and T and showers on 30th. Mean temp. 58°·5.

WALES.

HAVERFORDWEST.—There were six minima on grass below 32°, and 26° was recorded on the 16th, which committed sad havoc among the potatoes and

French beans; ash leaves were blighted as if by fire, and the young ferns were more or less destroyed. There has been no such frost in June in living memory in this locality. From the 25th to the end small quantities of R fell, but during the rest of the month almost absolute drought prevailed, with bright sunshine and high day temp. Straw will be very short, and in many localities green crops never came up. Prevailing wind E.N.E. and N.W.

GOGERDDAN.—Bright sunshine throughout, with N.W. and N.E. winds. Frosty mornings in the third week of the month.

SCOTLAND.

JEDBURGH.—The first half of the month was very dry and pastures and vegetation were much affected and hay is a light crop. Cereals looked well after the R in the last week but the straw will be short. T and L on 17th.

COLMONELL.—Rainfall 1·53 in. below the average of 19 years. T and L on the 26th, distant T on 29th.

MULL, QUINISH.—T on 29th. A dry hot month and crops suffered much from want of rain.

BRAEMAR.—T and L from 2 p m. to 4 p.m. on 19th and from 3 p.m. to 8 p.m on 26th.

ABERDEEN, CRANFORD.—The early part of the month was very dry. Vegetation stagnant in light soils.

CAWDOR [NAIRN].—Sharp TS and heavy H on 26th. Heavy showers and T on 29th and 30th.

ROEBERRY.—The first and latter parts of the month were fine, a cold snap occurring from the 9th to the 19th. On the evening of the 26th the heaviest TS experienced for many years occurred. Mean max. in shade 57°·9; mean min. 46°·7.

IRELAND.

DARRYNANE ABBEY.—A very fine and very hot month, the middle being particularly hot and bright.

O'BRIENSBRIDGE, ROSS.—A splendid month with much brilliant sunshine. Some welcome R at the close. Distant T on 28th and 29th.

DUBLIN.—This was an exceptionally favourable month. Fair and quiet weather held until the 26th, hot sunshine by day being often succeeded by calm cold nights especially about the 13th. From the 26th to the close violent electrical disturbances took place and R fell in abundance. Mean temp. 59°·2 or 1°·4 above the average. High winds were noted on only 4 days and the force of a gale was never attained. Temp. reached or exceeded 70° in the screen on 7 days. H fell on the 12th and 29th. Solar halos were observed on the 3rd, 8th, 11th, 13th and 23rd. TS occurred on the 26th, 29th and 30th.

WARINGSTOWN.—The rainfall of the last week did much good, but previous to that the state of the country was very critical.

EDENFEL.—With a continuance of deficient rainfall the month was most variable as to temp. the calm, hot and clear weather of the first week having given place on the 9th to a cold spell culminating on the 13th in a temp. of 30° in the screen and 25° on the grass and on the 15th of 31° and 27° respectively, the severest June frost ever recorded here. Potatoes and all tender plants in low situations were killed to the earth and the foliage of horse chestnut, rhododendron and laurel completely destroyed. With somewhat unsettled conditions a hot spell recurred during the fourth week followed by T, L, H and R.

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The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy.)

T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

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SYMONS'S
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CCCLV.] AUGUST, 1895. [PRICE FOURPENCE, or 5s. per ann. post free.

THE RAINFALL OF BELGIUM.*

OUR continental friends excel in drawing up programmes. The young and vigorous Geological Society of Belgium has not merely decided that Hydrology comes within its purview, but has drawn up a programme for the hydrological section of the Society, which seems to us well worthy of translation and publication as a type of what ought to be done.

(1) To determine how and in what quantities the rain falls over the country.

(2) What proportion runs off the surface, and how much penetrates?

(3) What becomes of the water that penetrates, how does it circulate, how does it accumulate in water-bearing strata, of large or small area, free or under pressure?

(4) What improvements, changes, or deteriorations can the water undergo in its course through the soil?

(5) How, in what quantities, and with what qualities more or less variable according to climatic or other influences, will it come out of the soil and return to the surface. What are the volumes and characters of the springs, brooks and rivers thus produced?

(6) What supplies either above or below ground feed the principal rivers?

(7) What has been the history of the modifications and changes in river waters in the past, how are they now used, and how could they be improved?

(8) What are the origin, volume, properties, and variations of the mineral waters, and for what are they useful, either in medicine or for trade purposes?

This is a grand programme, and we may all wish the society the power and the patience necessary for its complete fulfilment.

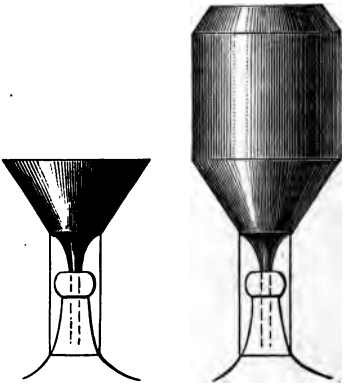
* *La Pluie en Belgique*, par A. Lancaster, Météorologiste-inspecteur à l'Observatoire royal, Membre-correspondant de l'Académie des Sciences. Premier Fascicule [Publication de la Société Belge de Géologie, de Paléontologie, et d'Hydrologie], Hayez, Bruxelles, 1894. 8vo, 224 pages, one plate and one large map.

It has certainly begun well. Acting on the well known principle, that if you want a heavy task well done you should give it to the busiest man that you know, the society asked M. Lancaster to deal with the first item. All that has yet been issued is now before us, and though this deals with only one part of the first item, it is quite sufficient to show that M. Lancaster is going to make it as good as is reasonably possible, and a very interesting work.

This first portion of the work consists of four sections :—

(1) The monthly fall at each station (arranged alphabetically) up to 1890 with the means for each month, and a few particulars as to the position of the gauges. We wish that these could have given more details—we miss any reference to the pattern or size of rain gauge, and (with few exceptions) to the height of the receiving surface above the ground. Another feature which we do not understand is the reason for sometimes placing the records together, as at Alost on page 3, and Anvers on page 7, and sometimes separating them, as at Bruxelles on page 21 and page 22.

With reference to the Brussels observations, we are much surprised to read, "Deux pluviomètres conjugés, ayant même ouverture rectangulaire (20 centimètres sur 10) ont constamment servi aux observations." We think that M. Lancaster will find that the Brussels' record, like many others, requires breaking up. If he will refer to Quetelet's *Météorologie de la Belgique*, 1867, p. 140, he will find that the gauges then in use were of the pattern shown in the following engraving, and he will, we think, find in the



foot note an indication of the origin of the rectangular gauges. It is to us a cause both of surprise and of regret that so distinguished a meteorologist as Quetelet should have made this change in the mode of observation without

(as far as appears) having established a series of observations so as to ensure the continuity of the record.

We are afraid that the effect of this change has been serious, and that the Brussels record cannot be trusted as any guide to secular change, because we find that there is a considerable increase in the mean fall after about 1867. We have taken out the mean fall for fifty years, and the means are as under :—

1840-9.	1850-9.	1860-9.	1870-9.	1880-9.
28·35	27·88	27·99	30·28	30·04
	28·07		30·16	

If we assume that the change was made in 1867 (the date of publication of the work above quoted) and take the means in two groups, we have—

Before (1833-66).	After (1867-90).
27·68 in.	30·39

It is impossible to say how much of this difference is due to change of pattern of gauge and how much to secular variation, but a change of 50 mm. in the means for such long periods as 30 and 20 years is at least ground for very close investigation.

(2) This gives the details for the years 1891 and 1892 which had been received before the printing of the earlier years had been completed, and therefore are given so as to strengthen the data on which the calculations and the map are based.

(3) This section may be described as the commencement of the text—it is entitled "Geographical distribution of rain in Belgium," and consists of an explanation of the mode of calculation employed, tabular statements as to the monthly seasonal and annual rainfall at 283 stations, and a general summary of the results graphically shown on the coloured map.

(4) The map is printed upon an index sheet to the Government maps, and is a handsome one about 3 feet by 2 feet, being on the scale of $\frac{1}{400,000}$, or about 6½ miles to an inch, with twelve degrees of intensity of blue colouring, one for each increase of 100 mm. (4 inches) of rain, so that all the features of the distribution are shown with great clearness. The map has several very good features—for instance, no place names are put upon the map except where observations have been made, and the place names are made to indicate the duration of the observations, thus—

Less than 5 years	...	Leuze.
Five to 10 „ ...	...	Uccle.
Ten to 15 „ ...	...	HEYST.
More than 15 years	...	**ALOST.**

As regards the distribution, those interested should procure a copy

of this valuable work, we can here indicate only the principal characteristics, viz.: a rainfall of between 20 and 30 inches over the W. and N. of the country, and from 30 to 40 inches over the whole of the S.E., exceeding 40 inches in the Ardennes and in two districts, one (the wettest of all) a few miles S.E. of Verviers, where we find Hockai, at an altitude of 1,762 feet, with a mean rainfall of 52·36 inches, and the other at Paliseul in the Ardennes with a fall of 48·03 inches, at 1,348 feet.

M. Lancaster rightly calls attention to the anomaly that, whereas in the British Isles it is the western shores on which the rainfall is large, it is exactly the reverse in Belgium. The matter must be further investigated, and it may prove to add one more to the many climatic features of Western Europe which are dependent on the course of the Gulf stream.

We congratulate the Geological Society of Belgium and M. Lancaster on the successful completion of the first instalment of their work.

AQUEOUS VAPOUR AND TEMPERATURE.

To the Editor of the Meteorological Magazine.

SIR,—The tables below give the result of an investigation I have been making, with the object of determining the effect of the aqueous vapour in the air on the range of temperature, in this part of the world. The method first adopted was to determine the dew-point at 8 p.m., by means of the wet and dry bulb thermometers and Glaisher's tables; against this, placing the fall in air temperature from 8 p.m. to the succeeding minimum. This was done for every absolutely clear night in the year ending June 30th, 1895, neglecting even those nights showing a trace of cloud on the horizon. The various dew-points were then arranged in a horizontal row, every corresponding fall of temperature placed in vertical columns below, and the average taken. The result is shown in Table 1. Col. 1 shows the dew points arranged in order from 26° and under to 58° and over; col. 2 shows the number of clear nights on which the respective dew-points occurred; col. 3 shows the range of fall, *i.e.*, the least and greatest falls observed corresponding to any given dew-point; col. 4 the average. To all appearance the result establishes nothing in particular. At the least it gives no support to the results arrived at by Tyndall in experimenting on the absorption of heat by aqueous vapour. [" *Heat, a Mode of Motion.*" Lect. xiii.]

The relative humidities were next tried in the same way, and apparently with better success. Table II. is the result. Col. 1 shows the various humidity-ratios arranged in order from 25 per cent. and under to 80 per cent. and over; cols. 2, 3, 4, as before; col. 5 shows the averages arranged in sets, 30 per cent. and under, 30 per cent. to 40 per cent., 40 per cent. to 50 per cent., and so on.

TABLE I.

Dew-point at 8 p.m.	No. of times Observed.	Range of Fall.	Average fall of Temp. to Min.
Degrees.		Degrees.	Deg.
26 & under	7	8 to 19	13·4
26 to 27·9	10	8 ,, 18	13·7
28 ,, 29·9	9	9 ,, 20	13·4
30 ,, 31·9	12	6 ,, 17½	11·5
32 ,, 33·9	10	11 ,, 19	14·7
34 ,, 35·9	15	9½ ,, 25	16·2
36 ,, 37·9	16	8 ,, 22	15·3
38 ,, 39·9	19	7 ,, 26	17·3
40 ,, 41·9	14	9 ,, 28	17·5
42 ,, 43·9	11	9 ,, 25¼	15·4
44 ,, 45·9	8	6¾ ,, 18	13·6
46 ,, 47·9	13	11½ ,, 24	14·5
48 ,, 49·9	11	10½ ,, 19	14·5
50 ,, 51·9	5	10 ,, 13	11·0
52 ,, 53·9	7	4¾ ,, 21	13·4
54 ,, 55·9	6	4½ ,, 16	10·7
56 ,, 57·9	1	...	9·5
58 & over	1	...	12·0

TABLE II.

Humidity at 8 p.m.	No. of times Observed.	Range of Fall.	Average fall of Temp. to Min.	Grouped Averages.
Per cent.		Degrees.	Deg.	Deg.
25 & under	5	14 to 21	18·2	
26 to 27	4	13 ,, 21	19·0	18·4
28 ,, 29	3	13 ,, 24	18·0	
30 ,, 31	4	18 ,, 25	21·2	
32 ,, 33	5	16 ,, 26	20·0	
34 ,, 35	5	15 ,, 20	17·6	18·6
36 ,, 37	5	10 ,, 28	18·4	
38 ,, 39	11	10 ,, 23	17·7	
40 ,, 41	3	14 ,, 18	16·0	
42 ,, 43	12	11 ,, 25	14·8	
44 ,, 45	12	6 ,, 22	16·4	15·9
46 ,, 47	4	14 ,, 19	16·2	
48 ,, 49	6	11 ,, 25	16·5	
50 ,, 51	7	12 ,, 24	15·2	
52 ,, 53	8	10 ,, 20	13·5	
54 ,, 55	13	9 ,, 21	14·0	13·6
56 ,, 57	5	10 ,, 18	14·2	
58 ,, 59	12	7 ,, 18	12·0	
60 ,, 61	6	8 ,, 16	12·3	
62 ,, 63	11	8 ,, 19	13·9	
64 ,, 65	7	5 ,, 18	12·1	12·9
66 ,, 67	6	11 ,, 16	13·5	
68 ,, 69	3	7 ,, 13	10·3	
70 ,, 71	4	8 ,, 15	12·5	
72 ,, 73	1	...	11·0	
74 ,, 75	1	...	12·0	11·6
76 ,, 77	2	9 ,, 11	10·0	
78 ,, 79	5	10 ,, 13	11·6	
80 & over	5	4½ ,, 12	9·0	9·0

TABLE III.

Month.	Range.	Diff. between Max. and Min.	Number of Clear Nights.	Percentage of Sunshine.
	Deg.	Deg.		Per cent.
July, 1894	56	35¼	20	85
August ,, ...	52	34	23	82
September ,, ...	56	34	11	80
October ,, ...	59¾	35½	15	71
November ,, ...	57½	35	14	80
December ,, ...	51	32	12	73
January, 1895	47½	32	10	76
February ,, ...	45	29	10	70
March ,, ...	47	26	9	60
April ,, ...	50	27	14	68
May ,, ...	58	30	18	83
June ,, ...	50	33	19	88

Here a very marked progression is evident, and granting the method of procedure to be trustworthy, it follows that the relative amount, rather than the absolute amount of water vapour, is the important factor in determining the energy of radiation here.

The matter may be summed up thus:—Given an air-temperature x, a corresponding dew-point y, with a humidity-ratio z. Also another air-temperature x^1, a corresponding dew-point y^1, with a humidity-ratio z^1. Let y^1 be greater than y; but z greater than z^1. Then according to Tyndall the fall of temperature following upon y will be greater than that following upon y^1, and moreover will be independent of x and z; whereas the figures here given seem to show that the fall of temperature in this case will be the other way about—since z is greater than z^1; in other words that the energy of radiation is independent of x and y, and varies as z.

There is one weak spot, at any rate, in my results: *e.g.*, the nights are not, of course, of the same length in summer and in winter. But on the other hand, the average humidity is higher in the winter, and assuming that, other things being equal, the total fall of temperature will be greater the longer the time given for it to take place in, it is clear that if the summer nights could be lengthened we should have a greater fall of temperature (corresponding to a low humidity-ratio) than is actually shown.

I hope later on to go into this matter somewhat more accurately and closely with a series of hourly observations, meanwhile this may be taken for what it is worth.

To make the investigation complete, it seems necessary to determine whether, under given conditions as to quantity of moisture, pressure, and wind, the fall of temperature will vary with its magnitude: for example, given a vapour tension of ·5 inch, a barometric pressure of 26·200 inches, and a N. wind, at 8 p.m.—

will the temperature fall more rapidly from, say, 70° to 60°, than from 50° to 40°. This I am undertaking. But it ought to take some years to finish satisfactorily.

Table III. is designed to explain any small points which may arise out of Tables I. and II. Col. 1 is the month; col. 2 gives the total range of temperature in any month; col. 3 gives the difference between mean maximum and mean minimum; col. 4 the number of clear nights; col. 5 the approximate percentage of sunshine to the greatest amount possible.

The two hygrometers made use of are in a large louvre-boarded screen, with their bulbs three feet above the ground. Long., 24° 27′ E.; lat., 28° 42′ S., approximately 3,900 feet above sea-level.

J. R. SUTTON, B.A. Cantab.

The Kenilworth Observatory, Kimberley, South Africa, July 12th, 1895.

[It is extremely satisfactory to find that accurate records are being kept at a locality of the climate of which so few data exist.—ED.]

A WHIRLWIND IN LA HAUTE-MARNE.

WE translate the following from a recent French newspaper because we wish to know whether any further details can be obtained respecting the fall of the barometer. We believe that when a whirlwind passes over a barometer, the latter (if of a kind capable of recording a sudden depression—which many are not) will give a record which will, to many persons, be a great surprise. A Richard barograph (of which there are many thousands now at work) ought to give such a record; but the difficulty is to secure one that shall be exactly in the centre of the track, and yet not be damaged by the storm. We call particular attention to the line printed in *italics*.

CHAUMONT,

July 30th, 1895, 4 *p.m.*

The news from the region devastated by the cyclone is most distressing, the disaster is greater than had been supposed. The cyclone ravaged the Canton of Poissons and afterwards entered the department of la Meuse near Gondrecourt.

Throughout its course all the crops were destroyed by the hail, though it lasted only 10 minutes. Trees were broken or torn up, and houses unroofed. At Champcourt, the church tower was overthrown, and the church thereby damaged.

The barometer fell suddenly from 760 mm. to 750 mm. (29·92 in. to 29·53 in.)

Happily no personal injury is reported. The sous-préfet of Wassy (on the 29th) visited the localities in the valley of the Blaise which seem to have suffered most severely.

REVIEWS.

Pubblicazioni della Specola Vaticana. Volume IV. Turin, 1894. 4to. xxvii.–620 pages, 42 photographic and other plates.

THIS sumptuous volume maintains in appearance the high level of merit which the series has taken from the very first, and of which we have already spoken.*

We think that we may claim credit for having suggested the first article. In connection with Mr. Wood's translation of Theophrastus we heard of a "Table of the winds" in the Museo Pio Clementino; we wrote to Padre Denza; with characteristic promptitude and kindness he found it, had it photographed and sent us both photographs and casts of it—but a photograph and several pages of comments are given in Theophrastus,† so we need not repeat the story here. Suffice it to say that we are glad to see the photograph again in this volume, accompanying a short memoir upon it by Padre Giuseppe Lais. The memoir does not profess to be an exhaustive discussion of the nomenclature of the winds, and excellent as was Mr. Wood's note upon the subject, we think that the last word has not yet been said. Padre Lais refers to papers by D'Averache, Gosselin and Bertelli; and there is altogether, in our opinion, ample material for careful study. This article seems to us to have been written or printed in a hurry; in the copy of the inscription wherever the Greek capital Λ (*i.e.* Λ) occurs it is printed A making the words look ridiculous; and two pages later we have N.W.E. for N.N.E.—a mere accident undoubtedly, but as a rule the printing of the *Pubblicazioni* is extremely good, and therefore we adhere to our inference that this article was printed in a hurry. However, it contains several useful references, and must not be ignored when, if ever, a complete monograph upon the nomenclature of the winds is prepared.

This article is followed by a note by Padre Denza on three old celestial globes; and then comes the ordinary commencement of the volume, with the report of the Annual Meeting of the Council of Direction, the speeches and reports as to progress, the state of the library, the visitors to the Observatory, &c. 115 pages are then devoted to astronomical work and 36 to terrestrial magnetism.

We cannot stop to notice all the meteorological articles but we have a suspicion that the very strange differences shown in the article by Prof. G. Busti entitled "Confronto dell'acqua caduta a diverse altezzi" are capable of easy explanation. We believe that the two rain gauges are read at different hours, and thus the daily amounts are not comparable. But these tables on pages 286 to 289 evidently need examination for the figures do not agree with those

* *Met. Mag.*, Vol. xxviii. p. 154.

† "Theophrastus of Eresus on Winds and on Weather Signs," by J. G. Wood, M.A. 8vo. Stanford, London, 1894.

in the monthly tables on pages 307 to 353, and on page 289 there is the obvious error of printing the values of December 1891 instead of those of Dec, 1892, as will be seen by referring to pages 287 or 353 But there are many errors all through this article, *e.g.* on May 13th, 1892, the record at the Specola should be 17·7 not 17·4, and it is quite certain that the amount in the garden on that day was forgotten to be entered. Moreover in the tables of differences the + and – signs are hopelessly mixed. We do not recollect ever seeing such bad work. To judge by the portion that we have tested there must be about 20 errors on each page. It is a comfort to think that Padre Denza has been spared having to examine it.

Nothing could surpass the beauty of the illustrations, and of the whole get up of the volume; but we are so disappointed at the result of examining this article, and it so discredits the parts of the book which we cannot test, that we have not the heart to go on with our notice.

The Clyde Sea Area, by HUGH R. MILL, D.Sc., F.R.S.E., Part III. "Distribution of Temperature." [Excerpt Trans., Roy. Soc., Edinb.] Edinburgh, Grant & Son, 1894. 4to, 162 pages; 32 plates (mostly coloured).

THIS is the concluding part of the great work which Dr. Mill has been doing in the lovely Lochs of the South-West of Scotland.. The observations were mostly made in 1886, '87 and '88; the results as regards salinity and specific gravity were published in 1892, and noticed in these pages in March 1894. The still heavier part of the work, that relating to the temperature of the water, was published in November 1894, and is now before us.

At the outset we wish to say a word as to the brilliancy and accuracy of register in the colour-printing of the plates accompanying this memoir. Keith Johnston used to send us beautiful specimens of his work, and these plates show that Edinburgh has equal reason to be proud of Bartholomew's.

As regards the paper, we cannot pretend in the limits at our disposal to give an exhaustive criticism. We adhere to the opinion which we expressed in our previous notice as to the seriousness of the omission of complete records of the winds, and we do not remember seeing, either in this or the previous part, any records of surface movements by bottles, as in Prof. Harrington's experiments upon the American lakes. We recognise to the full the labour which Dr. Mill devoted both to making the observations and to preparing this elaborate paper, also the impossibility of his printing *in extenso* the tens or hundreds of thousands of observations which he must have made, and yet without them it is not easy to decide upon the acceptance of all the propositions enunciated; some of them extremely difficult, *e.g.*, the estimation of the proportion of the increase in the

temperature of the water in summer, which is due to direct solar radiation, and that due to the entry of warm water from the Atlantic. As regards the diagrams, we think that the disproportion between the ordinates and abscissæ is too great. In plate viii. it seems to be about 2,700 to 1, and we also think that it would have been better to have adhered to one ratio throughout; whereas a depth of 100 fathoms corresponds to 50 miles on plate viii., to 15 miles on plates xii. and xix., and to 7 miles on plates xvi. and xvii. Most authors would resent the fixing of definite ratios for use in diagrams, but it would render them much more useful; say, for instance, that in barometic charts 1 inch of height should always correspond to 1 hour, or 1 day, or 1 month. As it is, the ratio is usually determined by the size of the page. In Dr. Mill's exquisite charts the bottom of the main channel suggests a section through the Cañons of the Rocky Mountains rather than the undulating base of a Scottish loch.

A SHOWER OF FISH ON JUNE 15TH.

In early times, records of the occurrence of showers of fish, corn, &c., were regarded as alarming portents.

Then came the time when they were regarded as fictitious—like the African lakes, Albert and Victoria Nyanza, which were erased from the maps for nearly 100 years—to be restored in the present century.

So with the fishes. We now know that the records of their falling are true, and we know where they come from. A whirlwind sucks up the water of a stream or pond, the water and the fishes are carried aloft—like the hay out of a field—and dropped down, a veritable shower of water and fish.

Here is the record from our observer, Mr. W. C. V. Burton, J.P., of Carrigaholt Castle, County Clare, Ireland :—

"On the 15th, a very hot day, some heavy heat drops fell about midday, when a number of small fishes (mostly about 1½ or 2 inches long) fell in the pleasure grounds, where some men were working. I sent a sample to the English and Irish *Times*, but I think that no notice was taken of them. I have a large one in spirits, and several people saw the fish."

THE HEAT IN SOUTHERN RUSSIA.

The Odessa Correspondent of the *Daily News* writes on August 5th: The oppressive heat continues unabated over the whole of Southern Russia and the Crimea. Yesterday the temperature on the South Crimean coast was 106 deg. Fahr. in the shade at 8 o'clock in the morning. At Kieff it was 104 deg. in the shade. Here, from

day to day, one looks vainly for the merest fleck of cloud in the lurid expanse of sky and horizon in the hope of discovering some sign of coming rain or thunderstorm. The country has a scorched and withered appearance, except in such happy oases and thinly-scattered patches where vegetation is kept alive by irrigation. The wells are drying up, and in many districts water-famine is added to the miseries of the general drought. The cattle have no green fodder, and the usual aftermath of hay is this season an entirely absent quantity. It is more than six weeks since we had rain, and during that period the weather has been gradually growing hotter day and night. To-day our temperature at noon was 108 deg. Fahr.

A TIDAL WAVE?

"One of those sudden and violent disturbances of the sea which the late Mr. R. Edmonds, of Plymouth and Penzance, attributed to submarine earthquakes, was witnessed on the north shores of Mount's Bay from 4.45 to 5.30 on Saturday evening, 10th. A tidal wave unexpectedly swept into the harbour of Penzance and Newlyn. At the latter place the pilchard fleet were under sail. One craft was swept against a steamer; others were hurried from the middle to the inner parts of the port. At Penzance boys who were pulling boats in the harbour were bewildered on finding themselves swirled helplessly hither and thither, and even the small steamers could barely stem the rush. It will be interesting to compare the disturbance with any others reported from the sea or the land."—*Western Mercury, August 12th,* 1895.

STORM CENTRES IN SWITZERLAND.

Professor Hess, of Frauenfeld, has published two interesting essays upon storm centres in Switzerland. His materials are partly taken from 4,000 weather reports issued by the Swiss Meteorological Institute, and partly from 200 observations of storms made by himself during the year 1892. He finds that the greater proportion of storms, 35 per cent., have their starting-point in the Swiss "middleland," that is, between the Alps and the Jura; 28½ per cent. in the region of the fore Alps, or Pilatus, Rigi, Niesen, &c.; 25 per cent. in the Jura; while only 11½ per cent. have their "Ausgangspunkt" in the high Alps. The "thickest" storm-centre, that is the greatest brooding spot of Swiss storms, lies in the Basler and Solothurner-Jura district. The second "thickest" is the upper part of the Lake Zürich, and the third is about the foot of the Sentis in the lands of Appenzell and St. Gallen.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1895.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	51·9	20	17·2	29	38·1	29·1	30·6	88	69·1	16·2	1·96	16	6·5
Malta	67·5	17	39·3	30	60·2	48·3	44·9	79	119·1	33·0	1·91	10	5·7
Mauritius	87·5	12	70·1	5	85·4	74·7	69·2	73	137·3	62·8	2·14	17	6·2
Calcutta	84·0	12	49·1	20	77·1	55·8	56·0	73	135·0	41·5	·00	0	1·0
Bombay	84·1	4	60·8	23	80·7	66·8	63·5	70	132·1	51·0	·00	0	0·9
Ceylon, Colombo	90·7	29	66·8	31	86·9	72·4	69·4	75	149·5	55·0	5·00	12	4·7
Melbourne	99·0	24	49·5	16	77·0	56·6	53·6	63	148·1	39·8	1·81	4	4·7
Adelaide	104·5	12	51·7	16	84·9	62·9	51·0	45	174·0	43·9	1·22	4	3·7
Sydney	90·3	25	59·0	27	74·3	64·8	61·3	77	151·1	54·0	8·07	25	7·7
Wellington	79·0	25	47·0	22	72·6	57·5	55·7	72	145·0	35·0	6·04	12	4·2
Auckland	79·5	27	57·0	17*a*	74·8	61·9	62·2	81	142·0	54·0	2·72	15	5·3
Jamaica, Kingston	88·6	31	63·6	6	86·2	66·7	65·6	76	...	...	·05	1	2·0
Grenada	84·6	5	69·0	29*b*	81·3	72·0	68·8	73	165·0	...	5·09	21	3·7
Toronto	42·2	21	—0·6	29	28·1	14·0	19·0	83	...	—6·0	4·65	20	7·2
New Brunswick, Fredericton	41·1	12	—12·7	26	24·7	5·1	14·0	83	...	...	4·50	...	5·4
Manitoba, Winnipeg	26·0	19	—37·9	30	2·2	—17·3	...	...	...	...	1·54	14	4·9
British Columbia, Esquimalt	53·6	12	25·2	3	41·0	32·9	35·0	90	...	...	6·94	21	8·1

a—and 20. *b*—and 30.

Remarks.

Malta.—Adopted mean temp. (53°·3), 0°·3 below the average. Mean hourly velocity of wind 13·1 miles. Thunderstorms on 2nd and 3rd, and lightning on 4 other days. Hail on 6 days. Sea temp. fell to 55°·5, the lowest recorded.
J. F. Dobson.

Mauritius.—Mean temp. of air 1°·1 above, dew point 0°·6 below, and rainfall 5·11 in. below, their respective averages. Mean hourly velocity of wind 12·7 miles, or 1·3 above the average; extremes, 38·8 on 13th and 1·9 on 7th; prevailing direction, E.S.E. to E. by N. Thunder on 12th. C. Meldrum, F.R.S.

Ceylon, Colombo.—Thunderstorms on 14th, 15th, 19th and 22nd, and lightning on 12th, 13th and 20th. D. G. Mantell.

Adelaide.—Mean temp. 0°·5 below the average of 38 years. Rainfall ·40 in. above the average, and nearly all falling on one day, the 4th. C. Todd, F.R.S.

Sydney.—Mean temp. 2°·3 below, humidity 4·5 above, and rainfall 4·32 in. above, their respective averages. Very heavy S. to S.E. gale, and tremendous seas at the end of the month. H. C. Russell, F.R.S.

Wellington.—Heavy rain during the early part of the month, 1·15 in. falling on 3rd, and 2·25 in. on 9th, and showery up to 12th, after which generally fine and pleasant weather, with moderate winds from N.W. Mean temp. 2°·4, and rainfall 2·14 in. above the average, R. B. Gore

Auckland.—Mean temp. and rainfall very close to the average of 28 years.
T. F. Cheeseman.

Jamaica, Kingston.—Mean hourly velocity of wind 4·6 miles. In Kingston the rainfall was nearly 1·50 in. below the average, and over the Island generally was only 35 per cent. of the average. R Johnstone.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	5·71	XI.	Lake Vyrnwy	5·79
,,	Birchington, Thor	3·29	,,	Corwen, Rhug	...
,,	Hailsham	3·60	,,	Carnarvon, Cocksidia ...	4·97
,,	Ryde, Thornbrough	3·84	,,	I. of Man, Douglas	3·18
,,	Emsworth, Redlands ...	4·67	XII.	Stoneykirk, Ardwell Ho.	2·48
,,	Alton, Ashdell.....	4·90	,,	New Galloway, Glenlee	6·11
III.	Oxford, Magdalen Col...	3·54	,,	Melrose, Abbey Gate...	5·83
,,	Banbury, Bloxham	3·22	XIII.	N. Esk Res. [Penicuick]	4·00
,,	Northampton, Sedgebrook	2·72	,,	Edinburgh, Blacket Pl..	4·66
,,	Alconbury	3·15	XIV.	Glasgow, Queen's Park.	3·81
,,	Wisbech, Bank House..	1·68	XV.	Inverary, Newtown	5·31
IV.	Southend	2·83	,,	Islay, Gruinart School..	3·66
,,	Harlow, Sheering	4·00	XVI.	Dollar.....	5·59
,,	Colchester, Lexden.....	3·67	,,	Balquhidder, Stronvar..	5·58
,,	Rendlesham Hall	3·86	,,	Ballinluig	2·59
,,	Diss	3·61	,,	Dalnaspidal H.R.S. ...	4·90
,,	Swaffham	3·63	XVII.	Keith H.R.S.	3·56
V.	Salisbury, Alderbury...	3·13	,,	Forres H.R.S.	2·37
,,	Bishop's Cannings	...	XVIII.	Fearn, Lower Pitkerrie.	2·75
,,	Blandford, Whatcombe.	3·05	,,	Loch Shiel, Glenaladale	...
,,	Ashburton, Holne Vic....	4·31	,,	N. Uist. Loch Maddy ...	6·06
,,	Okehampton, Oaklands.	4·06	,,	Invergarry	4·46
,,	Hartland Abbey	3·37	,,	Aviemore H.R.S.	2·85
,,	Lynmouth, Glenthorne.	3·99	,,	Loch Ness, Drumnadrochit	2·14
,,	Probus, Lamellyn	3·26	XIX.	Invershin	4·33
,,	Wellington, Sunnyside..	...	,,	Scourie	3·32
,,	Wincanton, Stowell Rec.	3·63	,,	Watten H.R.S.	2·48
VI.	Clifton, Pembroke Road	3·37	XX.	Dunmanway, Coolkelure	7·05
,,	Ross, The Graig	2·59	,,	Fermoy, Gas Works ...	6·11
,,	Wem, Clive Vicarage ...	3·36	,,	Killarney, Woodlawn ...	5·86
,,	Cheadle, The Heath Ho.	4·99	,,	Caher, Duneske	2·98
,,	Worcester, Diglis Lock	3·33	,,	Ballingarry, Hazelfort...	3·57
,,	Coventry, Coundon	3·14	,,	Limerick, Kilcornan ...	3·95
VII.	Ketton Hall [Stamford]	2·78	,,	Ennis	3·35
,,	Grantham, Stainby	2·65	,,	Miltown Malbay.....	5·40
,,	Horncastle, Bucknall ...	...	XXI.	Gorey, Courtown House	2·86
,,	Worksop, Hodsck Priory	3·79	,,	Athlone, Twyford	4·89
VIII.	Neston, Hinderton	3·99	,,	Mullingar, Belvedere ...	5·77
,,	Preston, Haighton	...	,,	Longford, Currygrane...	4·40
,,	Broughton-in-Furness..	6·66	XXII.	Woodlawn.....	5·32
IX.	Ripon, Mickley	4·72	,,	Crossmolina, Enniscoe..	6·00
,,	Melmerby, Baldersby	5·77	,,	Collooney, Markree Obs.	5·03
,,	Scarborough, South Cliff	4·85	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	6·87	XXIII.	Lough Sheelin, Arley ..	4·76
X.	Haltwhistle, Unthank..	4·77	,,	Warrenpoint	3·91
,,	Bamburgh.....	4·43	,,	Seaforde	4·31
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	5·84
XI.	Llanfrechfa Grange	4·17	,,	Bushmills, Dundarave/..	3·09
,,	Llandovery	5·38	,,	Stewartstown	3·79
,,	Castle Malgwyn	4·24	,,	Buncrana	4·36
,,	Builth, Abergwessin Vic.	6·85	,,	Lough Swilly, Carrablagh	5·10
,,	Rhayader, Nantgwillt..	5·06			

JULY, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATUR Max. Deg.	Max. Date	Min Deg.
			inches.	inches.	in.					
I.	ENGLAND.	London (Camden Square) ...	3·42	+ ·74	·57	27	12	82·0	8	47·7
II.		Maidstone (Hunton Court)...	4·87	+ 2·69	1·80	20	12	...	...	...
,,		Strathfield Turgiss	4·03	+ 1·64	·63	27	19	80·3	17	43·5
III.		Hitchin	4·78	+ 2·06	1·10	21	14	82·0	8	42·0
,,		Winslow (Addington)	3·63	+ ·34	·76	20	15	83·0	8	43·0
IV.		Bury St. Edmunds (Westley)	4·39	+ 1·82	·93	21	17	74·0	8	49·0
,,		Norwich (Brundall)	3·21	...	·66	27	16	81·0	8	46·0
V.		Weymouth(LangtonHerring)	2·38	+ ·23	·57	19	12	71·0	26	49·0
,,		Torquay (Cary Green)	2·73	...	·73	23	12	70·7	28	50·2
,,		Polapit Tamar [Launceston]..	3·68	+ ·27	·70	18	17	72·0	8	42·4
VI.		Stroud (Upfield)	2·83	— ·74	·55	19	12	78·0	9	50·0
,,		ChurchStretton(Woolstaston)	2·42	— ·55	·45	23	16	74·0	8	44·0
,,		Tenbury (Orleton)	2·58	— ·28	·74	21	13	79·0	8	41·0
VII.		Leicester (Barkby)	2·95	— ·04	1·35	18	15	84·5	8	38·0
,,		Boston	1·95	— ·84	·35	23	17	85·0	7	45·0
,,		Hesley Hall [Tickhill].....	4·08	+ 1·41	1·11	18	17	81·0	8	44·0
VIII.		Manchester(PlymouthGrove)	4·48	+ ·69	1·12	25	19	77·0	8	43·0
IX.		Wetherby (Ribston Hall) ...	4·36	+ 1·18	1·03	19	15	...	...	...
,,		Skipton (Arncliffe)	7·88	+ 2·24	2·66	25	22	..	...	...
,,		Hull (Pearson Park).	5·61	+ 3·02	1·62	25	17	82·0	8	42·0
X.		Newcastle (Town Moor)	4·37	+ ·85	1·23	25	19	...	...	...
,,		Borrowdale (Seathwaite).....	9·15	— 1·84	1·96	25	22	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·76	+ ·70	·74	23	16	...	...	...
,,		Haverfordwest	3·89	— ·32	·71	25	17	73·5	8	43·8
,,		Aberystwith (Gogerddan) ...	6·47	...	·95	24	13	77·0	6	34·0
,,		Llandudno.....	4·44	+ 1·44	·98	18	19	74·0	8	47·0
XII.	SCOTLAND.	Cargen [Dumfries]	5·99	+ 2·06	1·76	26	18	70·0	6	42·0
,,		Jedburgh (Sunnyside).....	5·48	+ 2·04	1·94	26	17	74·0	8	41·0
XIV.		Colmonell	4·18	...	1·25	21	17	80·0	6	37·0
XV.		Lochgilphead (Kilmory).....	4·32	+ ·02	1·19	26	16	...	...	40·0
,,		Mull (Quinish).....	5·12	+ 1·07	·73	7	19	...	...	...
XVI.		Loch Leven Sluices	4·50	+ ·88	1·00	27	14	...	...	...
,,		Dundee (Eastern Necropolis)	4·20	+ ·74	·75	18	19	79·6	7	43·9
XVII.		Braemar	3·19	— ·02	·56	18	21	71·0	6, 7	38·3
,,		Aberdeen (Cranford)	3·55	...	·70	26	18	75·0	6, 7	40·0
XVIII		Strathconan [Beauly]	5·50	+ 2·00	1·00	3	17	...	...	...
,,		Glencarron Lodge.....	7·42	...	1·06	21	24	67·0	8	37·5
,,		Cawdor [Nairn]	3·11	— ·19	·55	19	20	...	...	...
XIX.		Dunrobin	3·94?	+ 1·09	1·15	23	22	71·2	7	43·5
,,		S. Ronaldsay (Roeberry).....	2·41	+ ·05	·58	9	17	73·0	7	46·0
XX.	IRELAND.	Darrynane Abbey.....	5·44	...	·91	25	21	...	...	...
,,		Waterford (Brook Lodge) ...	4·06	+ ·53	1·02	25	16	71·0	12	45·0
,,		O'Briensbridge (Ross)	3·42	...	·48	25	19	...	...	...
XXI.		Carlow (Browne's Hill)	3·14	— ·38	1·15	24	15	...	...	...
,,		Dublin (FitzWilliam Square)	4·50	+ 1·82	1·26	25	16	73·8	6	48·1
XXII.		Ballinasloe	4·36	+ ·81	1·17	25	16	67·0	26	37·0
,,		Clifden (Kylemore)	8·97	...	1·70	7	23	...	...	...
XXIII		Waringstown	4·48	+ ·96	·76	2	21	79·0	6	43·0
,,		Londonderry (Creggan Res.).	5·16	+ 1·04	1·16	26	22	...	...	...
,,		Omagh (Edenfel)	4·43	+ ·71	·83	21	22	73·0	6	42·0

+*Shows that the fall was above the average*; —*that it was below it.*

METEOROLOGICAL NOTES ON JULY, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—In the early part of the month the weather was showery and unsettled; towards the middle it was more generally fine and dry. A wave of high temperature succeeded, but the end of the month brought heavy R storms, with T and L on the 21st and T on the 22nd.

ADDINGTON.—The long dry period was fairly broken on the 18th, and more or less R fell on every day until the 28th. The temp. was moderately high and vegetation of all kinds improved rapidly. T on 19th and 22nd, TS on 21st.

BURY ST. EDMUNDS, WESTLEY.—A wet month but the R came too late for the corn crops, which are the lightest remembered in West Suffolk. Vegetation made rapid growth, and the look out for stock is much improved. T on 1st, 19th, 21st, and 22nd. TS on 4th.

NORWICH, BRUNDALL.—Chiefly very fine and warm during the first fortnight, but very unsettled from the 18th to the end with copious rains. Mean temp. 61°·4, or exactly the same as in July, 1893 and 1894, and in close agreement with the average. R about a quarter of an inch above the average. Slight TS on 19th, distant T on 21st. Sharp TSS on 22nd.

LANGTON HERRING.—Very high wind on the 2nd; from the 3rd to the 16th inclusive, fine bright weather; wet and unsettled from 17th to 27th. Distant T on the 19th. Dense fogs on the 24th, 25th and 26th. Mean temp. at 9 a.m. 1°·6 below the average. The variations of temp. were very slight throughout the month. The average max., 67°·9, was slightly below that of June.

TORQUAY, CARY GREEN.—Rainfall ·07 in. below the average. Mean temp. 60°·2, or 1°·1 below the average. Duration of sunshine 179 hours 10 minutes, being 3 hours less than the average; 2 sunless days.

POLAPIT TAMAR.—Very free from strong winds throughout, but wetter than the average. The nights from the 17th to 26th inclusive were very close and hot, but the month altogether was decidedly cooler than June. Heavy TSS on 1st and 19th.

STROUD, UPFIELD.—Prevailing winds, N.W. and S.W. T on the 19th.

WOOLSTASTON.—The dry weather continued till the 16th and the want of water was severely felt, pastures being quite burnt up. In the latter part of the month, R fell almost daily. Mean temp. 58°·2.

TENBURY, ORLETON.—The first half of the month was dry and warm, but from the 16th to the end there was a considerable amount of R and very stormy unsettled weather. By a curious coincidence there was a considerable fall of R on the 1st, as was the case in both May and June. The temp. of the month was a little below the average. Frequent T—very heavy on the 21st—with a great fall of R for 20 minutes.

LEICESTER, BARKBY.—Continued drought till the 18th. T on 2nd, 19th, 21st, 26th and 27th. Mean temp. 62°.

MANCHESTER, PLYMOUTH GROVE.—The weather during the whole of the month was unsettled and cold. A great storm occurred on the 25th, and at Collyhurst the river wall of the Irk fell in and destroyed a small building; the rush of water was so great that a youth of 16 who was at work was swept away into the river and drowned. T and L and very stormy on 26th. Mean temp. 59°·5.

HULL, PEARSON PARK.—T on 19th, 21st, 22nd, 25th and 26th.

WALES.

HAVERFORDWEST.—The first few days were wet, followed by sunshine and warmth up to the 9th; damp days succeeded but it was again fine and bright

from the 11th to the 15th. From that date to the 27th almost constant R prevailed, although some of the days were fine with several hours of sunshine, the R falling at night. The last four days were beautifully fine and summer like. Stormy weather prevailed from 16th to 21st, causing heavy seas in the Irish Channel. Corn crops and cereals much improved by the damp warm weather, and grass lands looking well. Prevailing winds, S.W., S.E. and N.W.

GOGERDDAN.—Very stormy throughout the month, but "growing" weather.

SCOTLAND.

CARGEN.—A cold rainy sunless month. In only three years since 1860, viz., 1862, 1888 and 1890 has there been a lower mean temp. or less sunshine recorded at this station during the month of July. On the 25th and 26th a total fall of 2·88 in. of R was registered—yet another "record" in 1895,—the heaviest fall hitherto during two consecutive days being 2·60 in. on 13th and 14th July, 1882. The R caused a great improvement in pastures, hitherto hardly deserving that title but came too late to benefit the hay—barely half an average crop—the harvesting of which it made tedious and difficult. Cereals made good progress. T on 1st and 21st. T and L on 2nd and 26th.

JEDBURGH.—The weather was very variable and wet and vegetation advanced quickly. Cereal crops look well on the whole. Hay good but short, turnips are very good.

COLMONELL.—Rainfall ·75 in., above the average of 19 years. Mean temp. 57°·9 or 0°·7, below average.

MULL, QUINISH.—The drought of the last two months broke up on July 1st, and the month was very favourable for vegetation and crops. The R came too late to improve the rye grass but other crops improved immensely.

ABERDEEN, CRANFORD.—The frequent R was disastrous to the strawberry crops in this quarter which would have been "grand." Strong gales from N.W. on 10th and on 15th. N. and E. winds prevailed after the 16th.

ROEBERRY.—A fair month upon the whole but colder than July, 1894 by 2°·7. Mean temp. 54°·6.

IRELAND.

DARRYNANE ABBEY.—A very wet and cold month. 1·05 in. of R fell in seven hours on 17th.

O'BRIENSBRIDGE, ROSS.—Fair until 15th, but temp. low for the season, a fortnight of continuous R to the 27th, without sunshine and with still lower temp. Occasional T and L but not serious.

DUBLIN.—A cool, changeable month, setting in with heavy rains. Then high and squally S.W. to N.W. winds. Frequent rains from 15th to 25th inclusive. Fine, but cloudy at the close. TSS occurred on 19th and 21st; H fell on the 19th.

WARINGSTOWN.—The heavy rains although rather interfering with hay-making were most beneficial to the crops generally, which in this district promise to be very good, except upland hay which of course is short; turnips are making up for lost time rapidly.

EDENFEL.—A generally cloudy and unsettled month with temp. about the average and R considerably above it which—except by increasing the labour of saving the hay still in the fields—was of great benefit to grass and all crops.

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The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy.)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

Contains full Reports of the Meetings of the Royal Astronomical and Royal Meteorological Societies, and of the British Astronomical Association; Articles by various eminent Astronomers, English, American, and Continental; Correspondence on topics of interest connected with the Science; Notices of Observatories, Publications and current Discoveries. Notes on Meteors, on Variable Stars, on Lunar Formations, etc., also are supplied for the assistance and direction of observers.

The Observatory was founded in 1877, and has become an established and very valuable publication.—*Prof. Young, in "Ten Years' progress in Astronomy."*

All communications should be addressed to the Editors of "The Observatory," Royal Observatory, Greenwich, S.E.

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THE YORKSHIRE WHIRLWIND OF AUGUST 10TH.

HAPPILY, it is rare for a whirlwind to pass over a thickly populated district, and happily, also, the one of which we are about to give a description was not a severe one; but persons who have never been in the track of one, or visited it afterwards, are always so incredulous that we think it well, from time to time, to give full details. Usually we have to rewrite the account, so that the various facts may be in true sequence of time and of locality, but the account in the *Sheffield and Rotherham Independent* is fairly correct in both respects, and we therefore reprint it verbatim. We have left the word "cyclone" as used in the newspaper, although we do not consider that it ought to be employed for disturbances of such small diameter.

We would direct especial attention to the statement of Police Sergeant Barclay as extremely good.

The account was, of course, written for persons acquainted with the locality; we prefix a few words to make it generally available. The place of first reported damage is within a mile of where the first batch of rain-gauge experiments was made at Rotherham, in S.W. Yorkshire (Lat. 53° 25′ N., Lon. 1° 20′ W.); it passed over the Eastern side of Rotherham and down into the valley of Eastwood, then over Parkgate and up to Rawmarsh. The track is slightly E. of N., but not N.E., as stated in the newspaper.

The track herein described is slightly over two miles in length, but there seems some probability that the damage at Eckington (Derbyshire), mentioned in another account, was an earlier manifestation of the same whirlwind, because the Rotherham—Rawmarsh track produced 8 miles backwards would pass over Eckington; and as regards the thunderstorm—not the whirlwind—it may be of interest to mention that the track produced 11 miles Northwards would almost pass over the village where several houses were struck by lightning.

CYCLONIC STORM AT ROTHERHAM AND PARKGATE.

A storm of an exceptional kind devastated some parts of the Don Valley on Saturday. The thunderstorm began shortly before seven o'clock, and for a time it was accompanied with black clouds and a darkening of the heavens. Rain descended in torrents. The lightning flashed brilliantly, illuminating the earth.

The clouds assumed a striking aspect, being lighter at some points of the compass, and elsewhere of a deep purple hue. The cyclone began its ravages first in Rotherham in the neighbourhood of Red House, Moorgate, having probably started to the west of that locality. From the appearance of its traces, it would extend to a width of from 100 to 150 yards. The effects were made known at Red House, doing damage to a shed. Then it passed across towards Broom Wood. Trees were uprooted and others left standing stripped of leaves and branches. The crops ripening for the harvest on the farms of Mr. Ibbotson and Mr. Leedham were laid low. At Broom Wood the cyclone levelled several trees, and the roadway was blocked by a large elm. The highway was bestrewn with branches of trees, massive boughs from the parent stem. Crossing the road, the cyclone lifted the roof and part of the structure of the reserved and members' stands on the racecourse. The cricket field of the town club is adjacent, the pavilion and some sheds being on that side next the racecourse. The Wincobank and Town club teams had ceased to play and were sheltering. The roof of the stands from the racecourse dropped on the top of the cricketers' places of refuge with a force that must have frightened the timber wielders underneath. The fencing of the racecourse adjacent to Badsley Moor lane was levelled for a distance of about 70 yards. The effects of the cyclone were felt at the top of Clifton lane. In Badsley, Gilberthorpe, and Lister-streets branches were stripped off the ornamental trees and the gardens of the cottagers sustained much damage. Mr. Millett, of Gilberthorpe-street, had the skylight of his house damaged. The cyclone appeared to strike the houses at the east end of the street with the greatest force. Mr. Horne had a bedroom window blown in and a looking-glass placed on the bed without either being broken. Mr. Dean's fruit garden fared badly. Apple and pear trees were split and torn up by the roots. Ridge tiles and slates were removed from his dwelling. The roof of Mr. Hempshall's house was partially wrecked. The house of Mr. T. A. Cocking had the lead wrenched from the window top, and that occupied by our reporter, Mr. J. Bainbridge, was dealt with in a like fashion, and the ridging tiles of the roof and a window in the garret destroyed. Other damage was done at the rear of the premises. The remaining houses of the street did not escape injury. The worst sufferer in this locality was Mr. John Green, market gardener and farmer, who sustained loss through the damage to his garden, cow sheds, outhouses, and wash-kitchen. The Clifton Park presented a similar spectacle to that after the great wind storm of last January. Branches were torn from the trees, and valuable elm, beech, and hawthorns uprooted. An idea of the force of the wind was shown by one of the heavy iron seats having been lifted up and carried a distance of from 20 to 30 yards. Leaving the park by the gate opposite Cranworth-road, the cyclone continued its destructive powers in the grounds of Ald. George Neill, J.P., and Mr. C. B. Clarke, J.P. Passing from thence, by way of Cranworth-road, the cyclone was felt in Bethel-road, Eastwood Vale. Several yards of brick walling belonging to Mr. Eyre were thrown down, and the windows of Mr. Tee's house broken. Other property damaged in this neighbourhood include the Shakespeare Inn. and dwellings belonging to Mr. Lowe, Mr. Bowers, and Mr. Grafton. At Parkgate there were several narrow escapes of persons out in the storm, but no one has been reported as injured within the borough.

STATEMENTS BY EYE-WITNESSES.

Our reporter was away from home attending to his duties in another part of

the district. He had, therefore, no opportunity personally of watching the progress of the cyclone or describing it as an eye-witness. His eldest son, a youth of 18, has, however, furnished him with the following account of the incidents of the evening :—I was at home in this (the sitting) room looking at Eugene Stock's "Lessons on the Acts of the Apostles," with little baby sister asleep. The other members of the family were away engaged in various duties, so that practically I was alone. The storm began about a quarter to seven o'clock with some slight showers. Gradually the rain became heavier, the lightning flashed, and the thunder rolled. I noticed, as I glanced up from my book the lightning was forked and sheet, and of a deep blue colour, but there were one or two flashes of a crimson tint. The lightning was very vivid and bright, and the thunder like what I should imagine the noise of a battle would be when the artillery and rifles were fully in operation. Of course, after the recent heavy storm I did not consider there was danger ; I did not very much trouble myself about what was going on outside for some time. But there was some peculiarity, and perhaps the increasing severity of the lightning, thunder, and rain forced my attention from my preparation for Sunday. I stopped reading and looked out of the window. The rain was coming down in immense quantities, and there were one or two hail showers. The atmosphere, too, was uncomfortably oppressive. I had had the door leading into the yard open, and closed it. Every time the lightning flashed the rain descended in torrents, and then somewhat abated. It seemed as if the heavy showers immediately preceded and accompanied the lightning. This lasted for about 20 minutes. Semi-darkness prevailed, and the clouds appeared surcharged with electricity. I was looking towards the north, the view from the window being in that direction, so that I had my back to the approaching cyclone. I could not have seen it coming, from the room. But I heard and felt sure enough to satisfy me for a life-time. There was a tremenbous flash of lightning and heavy thunder. In a few minutes the wind began to roar. At first it heralded its approach by blowing strongly at the front of the house. Then there was a frightful whizzing noise. I could hear it travelling in this direction, and wondered what it meant. My curiosity was quickly satisfied. No, it was not a hissing sound. One of my friends, who was in Nelson-street, and out of the range of the cyclone, has told me he could only liken it to steam blowing loudly out of the safety valve of a number of boilers. It was worse than that here. Simultaneously, the back door was forced open, the ridging tiles of the roof were dashed to atoms in the yard, and a window was smashed in the garret. Doors were banged-to upstairs and downstairs. The whole structure of the building seemed to shake. I wish never to experience another few seconds like that. It took some force to close and lock the back door, smoke and soot came down the chimney and filled the room. I went upstairs to the front bedroom. The window was open a few inches from the top, but through the aperture had come more ventilation than was expected, for it managed to bring down the curtains, pole, and rings. In the garret a pane of glass was broken. A piece of some building, belonging perhaps to our neighbours in the next street, had been carried with such force that it passed through the window and dashed against the wall at the opposite side, and was knocked into pieces down the garret stairs. The glass of the window pane was broken into scores of little bits. What did I see of the storm outside ? Well, there were clouds of dust, then leaves and branches twirling in the most

fantastic manner, but I did not see very much of it. The real cyclone came with a mighty speed, and was here and gone in a few seconds. Little pebbles seemed to be striking the window and the walls. Besides, the atmosphere was suffocating, and events inside had crowded on me so fast. As you know the wind went over into the park, but spoiled my kidney beans on its way. When the wind subsided, which it did suddenly, I went to the garden gate and looked up and down Lister-street. Everybody had apparently rushed from their houses, and were enquiring of each other about the damage. The streets had the appearance of having been bombarded. I heard some of the people say they thought the world was coming to an end. I did not think that, but it was the most uncomfortable few seconds of my life. It was almost incredible —baby slept throughout the commotion." Coming in at a later hour, a younger boy's greeting was, "You look as if you had been in the wars in this locality." A resident at the other side of the street watched the progress of the cyclone. It had the appearance, he says, of a cloud of steam, capped by a cloud of dense blackness.

THE CYCLONE AT PARKGATE.

From several of the residents in Parkgate our representative late on Saturday night obtained accounts. They had been eye-witnesses of the storm. Police-sergeant Barclay, one of the steadiest and most respected members of the West Riding Constabulary, had a good opportunity to watch the course of the cyclone. He was in the neighbourhood of Manghani Quarry, and had a wide range of view. He described the scene as awfully grand, transcending anything he had ever witnessed. The clouds were light-coloured, turning round and rolling forward at the same time, meanwhile descending to earth and then rising higher. They varied in density, whirled round in a circle, and went in a north-easterly direction, but not in a direct straight line. They moved with rapidity, occupying but a short time in coming into and going beyond the range of vision. The noise was extremely great, and as if a lot of railway trains were running about at a breakneck speed to different parts of the globe. Mr. Newbould, jeweller, Broad-street, was standing at his shop door. The street had the appearance of the smoke and dust and flame of a huge puddling or blast furnace which had just been damped down. As he was looking out a slate struck the woodwork of the entrance door with much violence. The noise was deafening, and he heard the falling of chimney pots, tiles, slates, and the breaking of glass.

Entering Parkgate the cyclone first attacked Dilke's Buildings, or as they are generally known, Salt Lake. The gables of the cottages were damaged, the bricks falling into the bedrooms and smashing the furniture and crockery. The slates and roofing were carried away. Tiles and slates were strewn about in large quantities. Continuing towards the town, the cyclone stripped off slates from the blast engine house and fitting shops of the Parkgate Iron and Steel Company. Trees were torn up in the adjacent grounds of the company known as Parkgate House, Lloyd-street. At Eggleston's aerated water manufactory a new chimney stack was destroyed, and part of the house of the proprietor of the establishment was blown down. A shutter of the shop of Mr. F. L. Sharpe, butcher, at the corner of Broad Street and Lloyd Street, was seen to be lifted across the highway and over the Wesleyan Chapel opposite. Broad Street was a sad scene of wreckage, with glass, tiles, slates, chimney pots, and other *debris*. Half the roof had gone from the premises of Mr.

Binney, pork butcher. Three cottages behind the "Sportsman" Inn had suffered. The one occupied by Mr. W. H. Jarvis, a labourer at the steel works, had lost parts of the roof and gable. The bricks had fallen on the bedroom and demolished the contents, blocking up the stairs. The supports of the bedstead were forced through the ceiling into the living room. The windows of the house on both sides were smashed. In the next house Joseph Crabtree had three panes of glass broken, and William Harrison, the lamplighter, was similarly inconvenienced. The spouts and slates were dashed to the ground. The Sportsman Inn roof was damaged. Messrs. Bool Bros. had a rug in their yard which had been carried a distance of 200 yards, from Mason's, the pawnbroker. At the shop of Mr. Parkin, fruiterer, a large plate-glass window was smashed, and a hamper belonging to him was carried up Rawmarsh Hill beyond the Co-operative Stores. A large piece of leather belonging to Mr. J. Smith, draper, &c., was afterwards discovered in the same locality. A new plate-glass window, in size probably 12 ft. by 9 ft., was literally blown to pieces, at the shop kept by Mr. Schonut, pork butcher. The signboard of the Clarence Hotel was wrested from its fastenings and deposited higher up the street, near the shop of Mr. J. Smith. At the latter's shop a plate-glass window, about 9 ft. square, was destroyed. Mr. Smith had removed many of the goods usually hung outside the shop, but those left in the doorway were spun round like tops. The iron lamp-post belonging to the Urban Council, and used for street lighting purposes, was twisted and rendered useless. Nearly opposite, in a vacant piece of ground, Mr. P. J. Gilling had erected a substantial wooden structure in which to carry on business as an auctioneer. This was blown down, and Mr. Gilling estimates his damage alone at about £50. The course of the cyclone from the bottom of Rawmarsh Hill is not so clearly marked, but the work of destruction was not ended at this point. Half a mile away, in Stocks Lane, slates were torn off the house of Mr. Ward, newsagent, and the gable end of the cottage of Mr. N. Fieldsend, was forced in, and the furniture, &c., of the bedrooms demolished.

Mr. Wilson, the proprietor of vehicles running between Rotherham and Parkgate, was standing in the street at Parkgate with a omnibus. The horses became restive, and Mr. Wilson endeavoured to control them. Either by the force of the wind or some other cause the vehicle was overturned. Mr. Wilson was much bruised, and sustained a severe shock. A miner named Garbutt and his wife, who were in the vehicle, had a narrow escape.

A woman named Lound was in the shop of Mr. Schonut, pork butcher, when the window was broken, and was knocked against the counter and sustained fracture of two ribs.

A TIDAL WAVE.

To the Editor of the Meteorological Magazine.

SIR,—Referring to the tidal wave reported to have occurred in Mount's Bay, between 4.45 p.m. and 5 p.m. on August 10th, of which you quote particulars in your August number, some confirmation of the theory therein alluded to—viz., that tidal waves may be attributed to submarine earthquakes—may perhaps be gained from the following facts.

It is, I believe, considered by many that there is a connection between earth tremors and the force of the magnetic currents. If this be so, it may be of interest to mention that on examining the photographic curves from the self-recording declination, horizontal force and vertical force magnetographs at the Falmouth Observatory, I find that there was a considerable disturbance between the hours of 3 p.m. and 8.30 p.m. on the 10th of August. The most violent movement occurred shortly before 5 p.m. For several hours after 8.30 p.m. the photographic traces are of a particularly steady character. There does not appear to have been any simultaneous disturbance in the meteorological conditions, as the curves all run smoothly. The hourly values were—

	Barometer. at 32° in.	Temperature. Dry°	Wet°	Wind. Direction.	Velocity. miles.
4 p.m. ...	29·363 ...	63·3	61·6 ...	S.S.E.	10·5
5 p.m. ...	29·367 ...	61·0	59·8 ...	S.	12·0
6 p.m. ...	29·355 ...	60·2	59·2 ...	S.	14·0

It may be mentioned that our Observatory is distant about 24 miles in a direct line from Mount's Bay, where the force of the tidal wave was so severely felt.—Yours faithfully,

W. L. FOX.

Falmouth, 28th August, 1895.

MOCK-MOON PHENOMENON OF MAY 31ST.

To the Editor of the Meteorological Magazine.

SIR,—Having full view of this phenomenon from my windows, I made careful notes and drawings of it, from which the accompanying description and photograph are copied.

The evening was very mild, and a gentle breeze was moving from the S.E. The sky was veiled with a continuous but uneven film of cloud. I first noticed the phenomenon at 10.20 p.m., when the appearance was noted as follows:—The moon is surrounded with a silvery halo, which extends into four arms, two vertical, and two not quite horizontal, but curving upwards. The horizontal arms point to two large bright spots (mock-moons) of triangular shape, and iridescent with the red toward the moon. From these spots comet-like tails extend outwards and slightly upwards, and can be traced as far outwards from the spots as the latter are from the moon. The mock-moons are joined by a faint ring, which is *elliptical*, with the greater axis horizontal. There is no trace of a mock-moon at the lowest point; but at the highest point there is a nebulous patch having a convex lower border, and forming a kind of tangent arc.

10.45 p.m.—A second arc, of about 120°, has appeared above the main ring, and at a distance of one radius from it (or perhaps a trifle less). This second arc is as bright as the mock-moons, and *like them is iridescent, with the red edge toward the moon.*

11.0 p.m.—All has become faint, except the north mock-moon and the upper crescent.

11.6 p.m.—These have also faded away.

11.30 p.m.—A large filmy cloud to the S., having a large bright patch where the south mock-moon had previously been.

Within a minute or two of the last note, the whole phenomenon had disappeared; and the sky was quite changed, being clear and flecked with light and drifting clouds.

I regret that I had no instruments at hand to measure the angles subtended by the rings, &c.

F. J. ALLEN.

Mason College, Birmingham, July 15th, 1895.

LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—We observed a very fine lunar rainbow here last night, at 10.15 p.m. It spanned the northern sky in a perfect arc of brilliant white, its inner rim being pale blue, and its outer of an orange tint.

The conditions were very favourable to the production of these phenomena. It was the most magnificent of these rare phenomena I have ever observed. Weather very unsettled, and showery ever since.—I am, Sir, your obedient Servant,

CUMMINGS TRIPP.

Pinckney, Malmesbury, N.W. Wilts, August 3rd, 1895.

THE THUNDERSTORMS OF SEPTEMBER 7TH.

To the Editor of "The Times."

SIR,—As you have allowed me to give brief accounts of most of the thunderstorms of this year, it seems a pity to leave out those of Saturday morning. I was myself absent, but, as will presently appear, this was probably advantageous, as the automatic recording instruments here, coupled with the reports of Mr. Sowerby Wallis and of some of our assistants, enable me to give details not merely for this station, but for other localities also.

I was spending the night at Mr. Princes's observatory at Crowborough, about eight miles south-west of Tunbridge Wells. The observatory is on almost, or quite, the highest inhabited land in Sussex, and commands one of the largest sweeps of country I know of; Rochester, Hastings, Brighton, Eastbourne, Leith-hill, Knockholt Beeches were all visible from the top of the old observatory. We saw lightning over Lewes about 9 p.m. on the 6th, and at intervals till about 10.30 p.m., when we began also to hear long but distant thunder. The storm remained distant until about midnight, when it became severe, but was never within a mile of the hill; so that, while there was a blaze of light, no harm was done, and I do not think that the damage was proportional to the intensity of the storm, as most of the discharges passed from cloud to cloud, not from cloud to earth. Dr. J. Roberts, F.R.S., of the Starfield Observatory, which is almost adjoining, has a recording rain gauge, and it showed a fall of rain of 0·20 in. in about 15 minutes (midnight to 0.15 a.m.) and of another tenth before 2 a.m., after which no rain fell. This total, 0·30 in., was almost identical with Mr. Prince's, which was 0·33 in. We saw also much lightning about 4 a.m., probably that of the metropolitan storm, which was then in full action.

Turning now to Camden-square, I gather that, as regards frequency and brilliancy of lightning and loudness of thunder, the 4.30 a.m. storm much resembled that of the evening of August 22. The barometric disturbance and the rainfall were, however, greater.

The barometer fell 0·03 in. between 9 p.m. and midnight, and nearly 0·10 in. more by 3.10 a.m.; it was then steady for about an hour. At 4.15 a.m., when the storm burst over here, the first effect was a sudden further fall of 0·02 in., followed within a few minutes by a rise of nearly a tenth of an inch; the subsequent storms produced only slight effects.

The rain was very heavy, but not approaching the intensity of June 23rd, 1878. No rain fell till 3.15 a.m., when there was a sharp shower for a few minutes, yielding 0·03 in.; then at 4.20 a.m. came

a rush of rain, 0·42 in. being recorded by 4.30 a.m. (*i.e.*, 0·39 in. in ten minutes). It rained less heavily until 5.5 a.m., when 0·65 in. had fallen. Thence till 5.55 a.m. no rain fell, but in the next half-hour another two-tenths fell. From 6.30 to 7.35 no rain fell, but this was followed by a fall of 0·38 in. in little over a quarter of an hour, so that the total measured at 9 a.m. was 1·24 in.

There were at this station practically four storms—at 3.15 a.m., 4.20 a.m., 6.10 a.m., and 7.35 a.m. respectively.

It is too early to lay down the limits of the greatest rainfall, but the following records may be of interest:—Chiddingfold, Surrey, 0·30 in.; Starfield, Crowborough, Sussex, 0·30 in.; Observatory, Crowborough, Sussex, 0·33 in.; Crouch Hill, Middlesex, 1·10 in.; Upton, Slough, Bucks, 1·21 in.; Camden Square, London, 1·24 in.; Willesden, Middlesex, 1·48 in.; Cherry Orchard, Staines, Middlesex, 1·52 in.; *Bagshot, Surrey, 1·53 in.; Strathfield Turgiss, Winchfield, Hants, 1·78 in.; *Monk Sherborne Rect., Hants, 2.04 in.—Your obedient Servant,

G. J. SYMONS, F.R.S.

62, *Camden Square, N. W., September 9th.*

BELGIAN RAINFALL.

We have often expressed the belief that it is because of its smallness that the *Meteorological Magazine* is read so carefully; whatever may be the cause, we hold that it is a great compliment. Written as most of it is at high speed, it would be supra-human if it did not sometimes contain mistakes. Of course, we should prefer that there be none, but next to that we rejoice in their being corrected. This month we have to deal with two. As regards the first, a question of priority, we mentioned at the foot of page 103 that in M. Lancaster's handsome map of Belgian rainfall he had adopted the excellent plan of indicating length of observation by gradation in the prominence of type; we did not say that it was new (experience has taught us that it is dangerous to say that of anything), but we thought that it was. A correspondent, however, has pointed out that the plan was adopted 25 years since by Prof. Raulin in his *Observations Pluvio-métriques, France Méridionale.* M. Lancaster, therefore, was not the first to use the plan, but he did well to adopt it.

The other correction is, also, rather the supplying of additional information than the correction of an error. On p. 88, writing of Brussels Observatory, we said, "It is apparently the case that this observatory, upon which thousands of pounds have been spent, does not possess either a recording or a storm rain-gauge. We can arrive at no other conclusion from the fact," &c. M. Lancaster has asked us to state that the observatory has two self-recording rain-gauges, but that one was undergoing repairs, and the other failed. This, of course, was very aggravating, and we can quite sympathise with M. Lancaster in his annoyance; but we object to rain-gauges which fail at the critical moment, and we think that their names ought to be known as warnings of what patterns to avoid.

* Additional Records.

[The abstract of Dr. Forster's paper upon the above subject, which is given in *The Geographical Journal* (the official organ of the Royal Geographical Society), is of such interest to Meteorologists, that we are sure that our readers will be glad to see the following extracts from Mr. Dickson's excellent summary.]

TEMPERATURES OF EUROPEAN RIVERS,

By H. N. DICKSON.

IT seems almost inexplicable that, although important information is to be expected, and has indeed in many cases been obtained, from observations of river-temperatures, there is still only a small fraction of the meteorological stations situated on river banks which makes the recording of this element part of the ordinary routine. In a paper published recently by the University Geographical Institute of Vienna, Dr. Adolf E. Forster has collected most of the records of temperatures of European rivers which cover a long enough period to make them really useful, and the data are discussed with striking ability after the statistical methods still in most frequent use in this country. Each record is first criticized and valued on its own merits, the probable errors involved in different observational methods are discussed, and an attempt is made to reduce observations made at different hours to a true daily mean. The material available for ascertaining the form of the daily curve of temperature is extremely scanty, the most extensive hourly record being that of M. Renou in the Loire at Vendôme. The usual diurnal course seems to be a minimum at 8 a.m. in winter and 7 a.m. in summer, a maximum at 3 p.m. all the year round, the mean being crossed between 11 a.m. and noon. For a daily mean, however, single observations at 11 a.m., or two at 7 a.m. and 3 p.m., can leave little residual error. Observations at the two last-named hours give differences closely representing the daily range, and these exist for a considerable number of stations. The average range, as well as the mean variability, shows that in all cases the temperature of a river is in the first place controlled by that of the atmosphere, and this view is confirmed by the monthly and annual changes. Other factors—radiation, cloudiness, rainfall, evaporation, friction, thermal conductivity, heat capacity, &c.—are not without influence; but the most important is, as stated by Hertzer, certainly the temperature of the air.

Following this line, Dr. Forster devotes the main part of his paper to the relations between the temperatures of air and water at different seasons, and classifies the difference curves into four distinct types—rivers flowing from glaciers, from lakes, from springs and mountains, and rivers flowing through plains. Glacier streams, like the Rhine at Rheineck, the Inn at Fiefenbach, the Sill at Innsbruck, or the Rhone at St. Maurice, are markedly warmer than the air in winter, and colder in summer, the temperatures being equal about April and October. The defect in summer is usually sufficient to make the annual mean of the water at least 1·8° Fahr. below that of the air. To what distance the glacier influence may make itself felt depends,

of course, upon circumstances: on the Rhone it is distinctly recognizable 84 miles from the glacier, and on the Rhine 99 miles. Rivers flowing from lakes show a differential curve of a curiously characteristic type, strongly marked in the Rhone at Geneva, the Rhine at Alt-Briesach. the Ticino at Pavia, and the Mälar at Stockholm. In this case the mean annual temperature of the water is always above that of the air, the water being the warmer during the winter half-year to a much greater extent than it is the colder during summer. The outflowing water, in fact, closely follows the temperature of the surface layers of the lake, which remains relatively high during winter, inasmuch as the supply entering the lake from mountain and glacier streams, being colder than the main body, is denser and goes to the bottom, floating the warmer water up towards the surface. The Lake of Geneva and the Lake of Constance, for example, form in this way a kind of heat distributor, which tends to prevent the formation of ice in the Rhone and the Rhine. In the Rhine the lake influence is distinctly marked at Kehl, and even as far as Speyer; but in the Rhone the effect is neutralized by the rapid fall and the glacier waters of the Arve before Lyons is reached.

Streams derived from springs have the peculiarity that the water cools faster with low air temperatures than it warms with high, chiefly because the water is kept at a low temperature by the soil, and by melting snow and ice. This characteristic, however, seldom persists for any great distance from the source. In mountain streams, which give a nearly similar curve, the greater slope of the bed and the frequent occurrence of deep narrow valleys, protecting from radiation, make the typical form recognizable further than usually happens where the spring influence acts alone, and the transition to the last or plain type of curve is delayed. The distinguishing feature of rivers of the plains is that their waters have a higher mean temperature than the air in all months of the year; and such rivers can be further classified in three divisions—according as the excess is in summer greater than in winter, is equal in both seasons, or is in summer less than in winter. The first includes the true rivers of the plain—the Elbe, the Saale, the Weser, the Loire, the Seine, the Marne, and the Thames; the second rivers, which so far as has been observed, do not quite get rid of the marks of origin in mountain springs—the Vistula, the Warthe, the Zülligerbach, the Main, the Danube (Dillingen), the Egge, the Lech, and the Wien; while the third is simply an intermediate form, represented by the Oder, the Moldau, the Schloitzbach, and perhaps the Saône. It is obvious that the tendency must always be for all types to degenerate into the first division of the last, becoming gradually rivers of the plain. As Dr. Forster points out, there are probably really two forms of this type—that just noticed, where the water is always warmer than the air, and another where it is always colder. The latter form must be confined to countries where protracted frosts do not occur, and we have no example of it in Central Europe.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1895

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	46·2	23	7·3	8	36·1	22·5	21·1	76	80·8	5·0	·12	4	5·8
Malta	70·5	27	54·2	19	62·0	50·3	47·6	80	121·6	31·7	1·08	9	6·7
Mauritius	89·5	18	66·8	14	85·4	72·5	67·8	72	136·6	58·2	2·97	14	5·3
Calcutta	87·9	27	52·5	8	82.2	58·7	56·4	65	145·8	43·3	·02	2	1·3
Bombay	91·4	21	61·4	4	83·0	68·2	64·4	68	141·4	49·8	·07	1	1·7
Ceylon, Colombo	91·7	21	69·8	...	88·7	72·9	69·6	73	144·0	57·0	·81	5	1·5
Melbourne	100·6	13	50·3	11	82·4	58·0	54·8	61	150·6	38·5	·74	5	4·0
Adelaide	105·4	12*a*	53·0	9	87·2	64·5	52·1	44	165·0	43·7	·02	2	3·1
Sydney	90·2	28	60·8	3	75·9	64·9	62·1	74	146·0	52·9	6·67	21	5·8
Wellington	88·0	20	49·8	8	70·7	56·3	53·1	69	142·0	30·0	5·32	10	3·9
Auckland	85·0	18	55·5	24	73·7	62·0	61·1	81	145·0	52·0	2·20	9	4·9
Jamaica, Kingston	88·5	1, 2	64·1	6	85·3	67·0	66·0	76	...	...	2·20	3	4·0
Grenada	86·0	12*c*	69·0	20*b*	81·7	71·6	66·8	69	156·4	...	4·87	15	2·6
Toronto	44·3	27	—21·2	6	24·1	8·7	15·0	81	...	—27·0	·40	17	6·3
New Brunswick, Fredericton	41·0	19	—12·5	1	26·6	3·5	10·3	78	...	...	2·30	12	5·4
Manitoba, Winnipeg	41·2	26	—45·5	5	11·7	—11·5	...	...	...	...	1·18	11	4·7
British Columbia, Esquimalt	54·1	26	30·2	10	47·5	38·1	38·9	85	...	...	2·62	18	8·1

a—and 13. *b*—and 21. *c*—and 27.

REMARKS.

MALTA.—Adopted mean temp. (55°·3), 1°·6 above the average. Mean hourly velocity of wind 12·8 miles. Average temp. of sea 58°·5. Thunderstorm on 7th. Dew point ranged from 27°·9 on 19th to 56°·0 on 26th. The min. on grass on the 19th is the lowest reading recorded here. J. F. DOBSON.

Mauritius.—Mean temp. of air equal to, dew point 2°·2 below, and rainfall 3·09 in. below, their respective averages. Mean hourly velocity of wind 9·1 miles, or 2·1 below average; extremes, 23·1 on 24th and 0·0 on 11th; prevailing direction, E.S.E. Lightning on 2nd, 5th, 16th and 28th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 3rd, 4th and 5th. Thunderstorms occurred on the 24th and 25th. D. G. MANTELL.

Adelaide.—Mean temp. 2°·1 above the average of 38 years. Rainfall very light, ·60 in. below the average. C. TODD, F.R.S.

Sydney.—Mean temp. 0°·5 below, humidity 4 below, and rainfall 1·15 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Showery up to the 11th, with moderate N.W. and S.E. winds. Rain on the 11th, 3·39 in., causing floods, with light S. wind. Lightning on night of 10th. The remainder of the month fine, with northerly winds, except showers on 21st, 23rd, and 24th. Max. shade temp. (88°) the highest ever recorded in Wellington. R. B. GORE.

JAMAICA, KINGSTON.—Weather fine excepting the last week. Mean hourly velocity of wind 4·3 miles. Rainfall three times the average. R. JOHNSTONE.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			
II.	Dorking, Abinger Hall.	3·39	XI.	Lake Vyrnwy	5·72
,,	Birchington, Thor	1·74	,,	Corwen, Rhug	1·58
,,	Hailsham	2·27	,,	Carnarvon, Cocksidia ...	2·66
,,	Ryde, Thornbrough	2·65	,,	I. of Man, Douglas	5·28
,,	Emsworth, Redlands ...	2·95	XII.	Stoneykirk, Ardwell Ho.	4·47
,,	Alton, Ashdell.....	2·56	,,	New Galloway, Glenlee	7·75
III.	Oxford, Magdalen Col...	2·40	,,	Melrose, Abbey Gate...	4·09
,,	Banbury, Bloxham	1·74	XIII.	N. Esk Res. [Penicuick]	6·35
,,	Northampton, Sedgebrook	1·78	,,	Edinburgh, Blacket Pl..	5·12
,,	Alconbury	2·18	XIV.	Glasgow, Queen's Park.	6·02
,,	Wisbech, Bank House..	2·64	XV.	Inverary, Newtown	12·01
IV.	Southend	2·03	,,	Islay, Gruinart School..	5·03
,,	Harlow, Sheering	1·96	XVI.	Dollar.....	10·60
,,	Colchester, Lexden.....	1·60	,,	Balquhidder, Stronvar..	8·65
,,	Rendlesham Hall	1·70	,,	Ballinluig	6·44
,,	Diss	4·13	,,	Dalnaspidal H.R.S. ...	7·13
,,	Swaffham	3·32	XVII.	Keith H.R.S.	3·10
V.	Salisbury, Alderbury...	2·13	,,	Forres H.R.S.	2·90
,,	Bishop's Cannings	3·34	XVIII.	Fearn, Lower Pitkerrie.	2·16
,,	Blandford, Whatcombe.	3·16	,,	Loch Shiel, Glenaladale	10·17
,,	Ashburton, Holne Vic....	4·13	,,	N. Uist. Loch Maddy ...	5·86
,,	Okehampton, Oaklands.	4·54	,,	Invergarry	6·22
,,	Hartland Abbey	3·16	,,	Aviemore H.R.S.	3·42
,,	Lynmouth, Glenthorne.	5·34	,,	Loch Ness, Drumnadrochit	3·64
,,	Probus, Lamellyn	2·54	XIX.	Invershin	4·94
,,	Wellington, Sunnyside..	...	,,	Scourie	4·68
,,	Wincanton, Stowell Rec.	4·02	,,	Watten H.R.S.	2·16
VI.	Clifton, Pembroke Road	3·57	XX.	Dunmanway, Coolkelure	7·37
,,	Ross, The Graig	2·22	,,	Fermoy, Gas Works ...	...
,,	Wem, Clive Vicarage ...	2·87	,,	Killarney, Woodlawn ...	4·81
,,	Cheadle, The Heath Ho.	3·53	,,	Caher, Duneske	4·80
,,	Worcester, Diglis Lock	2·20	,,	Ballingarry, Hazelfort...	4·38
,,	Coventry, Coundon	2·86	,,	Limerick, Kilcornan ...	3·78
VII.	Ketton Hall [Stamford]	2·05	,,	Ennis	3·64
,,	Grantham, Stainby	1·49	,,	Miltown Malbay.....	5·30
,,	Horncastle, Bucknall ...	2·22	XXI.	Gorey, Courtown House	4·92
,,	Worksop, Hodsck Priory	1·30	,,	Athlone, Twyford	5·88
VIII.	Neston, Hinderton	2·29	,,	Mullingar, Belvedere...	6·32
,,	Preston, Haighton	4·49	,,	Longford, Currygrane...	...
,,	Broughton-in-Furness..	5·61	XXII.	Woodlawn.....	6·06
IX.	Ripon, Mickley	3·23	,,	Crossmolina, Enniscoe..	6·23
,,	Melmerby, Baldersby ...	2·22	,,	Collooney, Markree Obs.	4·66
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton..	2·53	XXIII.	Lough Sheelin, Arley ..	5·95
X.	Haltwhistle, Unthank..	4·80	,,	Warrenpoint	6·85
,,	Bamburgh.....	4·15	,,	Seaforde	6·56
,,	Keswick, The Beeches..:	...	,,	Belfast, Springfield	5·95
XI.	Llanfrechfa Grange	4·34	,,	Bushmills, Dundarave...	3·91
,,	Llandovery	5·67	,,	Stewartstown	4·79
,,	Castle Malgwyn	3·61	,,	Buncrana	...
,,	Builth, Abergwessin Vic.	5·87	,,	Lough Swilly, Carrablagh	5·92
,,	Rhayader, Nantgwillt..	4·88			

AUGUST, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Da
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	3·09	+ 1·21	·67	10	18	81·3	21	46·0	2
II.		Maidstone (Hunton Court)...	1·45	— ·24	·50	10	11	...	...	...	..
,,		Strathfield Turgiss	1·77	+ ·06	·38	13	18	79·4	19	40·5	2
III.		Hitchin	5·03	+ 3·21	1·35	21	15	80·0	22	44·0	2
,,		Winslow (Addington)	2·19	+ ·22	·43	13	17	81·0	22	40·0	2
IV.		Bury St. Edmunds (Westley)	4·08	+ 1·88	1·39	13	13	77·0	22	47·0	2
,,		Norwich (Brundall)	3·45	...	1·18	13	16	80·4	22	44·2	2
V.		Weymouth(LangtonHerring)	2·69	+ ·76	·72	12	16	71·0	22	48·0	2
,,		Torquay (Cary Green)	2·41	...	·66	10	16	70·4	19*a*	47·8	
,,		Polapit Tamar [Launceston]..	3·29	+ ·81	·56	7	17	73·0	18	38·5	2
VI.		Stroud (Upfield)	3·07	+ ·98	·60	5	20	77·0	22	48·0	
,,		ChurchStretton(Woolstaston)	2·70	— ·06	·80	10	18	76·0	22	44·0	2
,,		Tenbury (Orleton)	2·40	+ ·28	·51	12	16	77·8	22	37·8	2
VII.		Leicester (Barkby)	1·63	— ·81	·25	5	18	81·0	22	36·0	2
,,		Boston	2·61	+ ·49	·65	5	13	84·0	18	57·0	1
,,		Hesley Hall [Tickhill].....	1·42	— ·74	·36	3	18	80·0	18	39·0	2
VIII.		Manchester(PlymouthGrove)	3·55	+ ·46	·80	26	17	80·0	26	42·0	2
IX.		Wetherby (Ribston Hall) ...	3·50	+ 1·16	·92	11	10	...	...	...	..
,,		Skipton (Arncliffe)	5·28	+ ·95	1·06	26	21	..	...	...	..
,,		Hull (Pearson Park).	3·65	+ 1·01	·84	6	16	79·0	21	41·0	2
X.		Newcastle (Town Moor)	3·86	+ 1·15	1·38	4	16	...	...	...	..
,,		Borrowdale (Seathwaite).....	15·21	+ 6·76	4·44	26	24	...	...	...	..
XI.	WALES.	Cardiff (Ely).....	4·38	+ ·77	1·14	12	18	...	...	...	..
,,		Haverfordwest	4·61	+ 1·43	1·08	10	20	73·3	17	42·9	
,,		Aberystwith (Gogerddan) ...	5·63	...	1·40	26	16	80·0	18	34·0	7,
,,		Llandudno.....	1·79	— ·57	·34	26	19	78·0	18	47·8	
XII.	SCOTLAND.	Cargen [Dumfries]	6·62	+ 3·63	·78	26	23	76·4	17	43·0	2
,,		Jedburgh (Sunnyside).....	3·33	+ 1·09	·81	5	21	80·0	17	45·0	1
XIV.		Colmonell	5·08	...	·73	26	21	75·0	20	44·0	
XV.		Lochgilphead (Kilmory).....	6·62	+ 2·06	1·11	29	24	...	...	40·0	2
,,		Mull (Quinish).....	5·95	+ 1·80	1·22	28	25	...	...	...	..
XVI.		Loch Leven Sluices	6·50	+ 3·56	1·50	5	19	...	...	...	..
,,		Dundee (Eastern Necropolis)	4·55	+ 1·98	·55	28	23	77·3	18	39·9	2
XVII.		Braemar	4·93	+ 1·60	1·65	23	25	70·3	17	36·3	1
,,		Aberdeen (Cranford)	3·52	...	·56	11	22	77·0	17	42·0	
XVIII		Strathconan [Beauly]	6·60	+ 3·30	1·40	12	16	...	...	...	...
,,		Glencarron Lodge.....	7·95	...	2·19	29	24	72·6	17	43·0	
,,		Cawdor [Nairn]	3·21	+ ·96	·45	13	24	...	...	...	...
XIX.		Dunrobin	3·30	+ ·90	·68	29	18	71·0	18	43·0	2
,,		S. Ronaldsay (Roeberry).....	2·17	— ·39	·83	29	15	69·0	17	46·0	24
XX.	IRELAND.	Darrynane Abbey.....	5·63	...	·99	10	23	...	...	...	...
,,		Waterford (Brook Lodge) ...	4·78	+ 1·36	1·04	25	17	70·0	14	41·0	25
,,		O'Briensbridge (Ross)	5·69	...	1·22	20	25	...	...	...	...
XXI.		Carlow (Browne's Hill)	4·95	+ 1·98	1·12	22	25	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·55	+ 1·03	·70	10	27	71·7	28	46·3	25
XXII.		Ballinasloe	4·47	+ 1·29	1·20	26	26	70·0	17	44·0	24
,,		Clifden (Kylemore)	8·44	...	1·18	22	25	...	...	...	...
XXIII		Waringstown	4·57	+ 1·46	·56	26	25	75·0	16*b*	42·0	7,
,,		Londonderry (Creggan Res.).	5·65	+ 1·53	1·26	3	27	...	...	...	...
,,		Omagh (Edenfel)	6·65	+ 3·16	·77	23	25	70·0	16	42·0	4

+Shows that the fall was above the average; —that it was below it.
a—and 30. b—and 17. c—and 25, 27, 29.

METEOROLOGICAL NOTES ON AUGUST, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month opened with very unsettled weather, with frequent and heavy R accompanied by T, and continued so until the 14th. Towards the middle of the month a gradual improvement set in, with fine and bright weather to the close. TSS on 10th, 21st and 22nd; T on 1st, 2nd and 6th.

ADDINGTON.—The first fortnight was unsettled with a good deal of R. On the 4th a violent TS occurred with R but no H, while at Winslow, two miles distant, a heavy H storm did much damage to vegetables, &c.; T on the 10th and again at 2 a.m. on the 22nd with almost constant L, and another heavy TS at 8 a.m. the same morning. The remainder of the month fine.

BURY ST. EDMUNDS, WESTLEY.—The first half of the month was very wet with many TSS. Large H stones fell on the night of the 10th during a TS; the 13th was very wet, the rain coming from the S.E. and N.E. The latter half of the month was very fine and warm. TSS on 2nd, 6th, 10th, 12th and 21st, and T on 3rd, 4th, 5th, 13th, 14th and 22nd.

NORWICH, BRUNDALL.—To the 14th very showery and unsettled, but the last half of the month chiefly very fine with many warm days. Mean temp. of the month 61°·9, about 1° above the average, and about 2°·5 above August, 1894. TSS on 2nd, 7th, 10th, 12th, 13th and 22nd; T on 6th and 14th.

LANGTON HERRING.—From the 1st to 14th inclusive very unsettled weather; fine but rather hot from the 16th to the 24th. The night of the 21st and 22nd —during which there was a TS—was very hot, the min. temp. being 62°. Beautifully fine summer weather for the last five days. The average temp. at 9 a.m., 61°·8, is 0°·3 below the average of 23 years, but the average min. is 0°·4 above the average. Fogs on the 22nd and 23rd.

TORQUAY, CARY GREEN.—Rainfall ·45 in. below the average; mean temp. 60°·1 or 1°·4 below the average. Duration of sunshine 188 hours, being 20 minutes above the average; 1 sunless day.

POLAPIT TAMAR.—The first fortnight was very wet, the total for the month being considerably in excess of the average.

STROUD, UPFIELD.—Prevailing winds S.W. and W. T on 4th and 23rd; T and L between 1.30 and 2.30 a.m. on 22nd.

WOOLSTASTON.—A very fine harvest month. T and L on 10th, and very vivid sheet L on 22nd. Mean temp. 58°·5.

TENBURY, ORLETON.—The first half of the month was wet and rather cooler than the average, but from the 16th to the end was very fine and warm, with a larger proportion of sun than usual. Mean temp. of the whole month more than 1° above the average of 34 years. T on the 2nd, 4th, 10th and 22nd; T and L on the 22nd.

LEICESTER, BARKBY.—Wet (but not heavy R) almost every day for the first two weeks. A very warm month, with warm nights except on the 24th. L and T on 2nd, 10th and 22nd. Continuous sheet L on the nights of 23rd and 24th. Corn harvest not completed at the end of the month, about an average yield. Mean max. temp. 72°·8, mean min. 50°·2, mean temp. 61°·5.

MANCHESTER, PLYMOUTH GROVE.—The weather up to the 15th, was unsettled, but from the 16th to the 23rd summer weather prevailed. From the 24th to the end of the month the weather was unsettled and much colder. T and L on the 23rd and 27th. Mean temp. 61°·5.

HULL, PEARSON PARK.—TS with H on 6th, and TSS on 10th, 14th, 22nd and 27th.

WALES.

HAVERFORDWEST.—This month was characterised by much sultry heat, although no very high temperature prevailed. The nights were oppressive and the rainfall was considerable. Aurora was seen on two or three nights. Prevailing wind S.W. TS on 23rd.

ABERYSTWITH, GOGERDDAN.—Stormy throughout the month and very growing weather. T frequent.

SCOTLAND.

CARGEN.—The light rainfall of the first six months is being compensated for by an excess of 5·38 in. in the months of July and August. The heavy fall of July, so much exceeding the average, has been followed by a heavier and almost equally excessive amount in the past month. During the two months 12·61 in. has fallen, an amount never previously registered for these two months since observations commenced 36 years ago. The average R for July and August is 7·23 in.; the nearest approach to this year's record is 11·95 in. in July and August, 1873, and 11·78 in. in July and August, 1877. In only two other years, 1861 and 1891, has the rainfall of these months reached double figures. Sunshine is considerably below the average. A remarkable feature of the month has been the prevalence of southerly wind, south wind prevailing during 17½ days, while the average for the month is only four and a half, and the highest previous record nine. The damage done to the cut and growing corn is most serious, the muggy wet weather causing sprouting within a very few days of cutting. A great quantity of meadow hay must be irretrievably damaged. Potato disease made somewhat sudden appearance towards the end of the month. On the other hand the turnip crop shews great improvement, and pastures were never more luxuriant at this season. T and L on 6th, 11th and 14th, and T on 10th and 27th.

JEDBURGH.—The weather was very unsettled, the showers being often heavy. Good crops of turnips and potatoes, and the latter free from disease.

COLMONELL—Rainfall 1·09 in. above the average of 19 years.

ABERDEEN, CRANFORD.—The month was very hot, with very little sunshine. Considerable electrical disturbance around, the TS8 following the line of the mountains, and being very severe from 30 to 40 miles to west and north, in the line of the Grampians and Benachie.

ROEBERRY.—A very fine month. Mean temp. 57°·2.

IRELAND.

DARRYNANE ABBEY.—A very wet month, cold and windy also. Great TS (very unusual here in summer) between 9.30 p.m. and 11.30 p.m. on 22nd, with heavy R; very heavy R also (·71 in.) between 2 and 4.30 p.m. on 10th.

WATERFORD, BROOK LODGE.—A heavy wet month with a good deal of L. Thick fog on five or six days.

O'BRIENSBRIDGE, ROSS.—A most unfavourable month, involving delay and serious damage to the hay crop. T and L frequent and especially severe on the night of the 22nd, and attended with many casualties. Range of temp. high; prevalent wind S.W.

DUBLIN.—Like August, 1894, this month was very rainy, R falling on 27 days. Unlike August, 1894, however, the month was fairly warm, the mean temp. being slightly above the average. This was due to comparative warmth by night, the mean min. temp. being 54°·2, compared with the average 53°·6, while the mean max. was exactly the average, namely 65°·8. There was an overwhelming prevalence of S.W. and W. winds. Two-thirds of the sky was clouded throughout the month, compared with three-fourths in August, 1894. TS on 11th.

WARINGSTOWN.—Rain very frequent and consequently a bad month for hay making. Weeds rampant.

EDENFEL.—A humid, warm and wet month, with R nearly double the average, deposited mostly in torrential showers. Harvest delayed, and late meadows in a precarious state. After-growth of vegetation abnormal luxuriant.

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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
(Savilian Professor of Astronomy.)
T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

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THE BRITISH ASSOCIATION AT IPSWICH.

Although there were not many meteorologists at the Ipswich Meeting, meteorology came more to the front than usual. The President (Sir Douglas Galton, K.C.B.) devoted to it the following portion of his address :—

METEOROLOGY.

At the first meeting, in 1831, Professor James D. Forbes was requested to draw up a report on the state of meteorological science, on the ground that this science is more in want than any other of that systematic direction which it is one great object of the Association to give. Professor Forbes made his first report in 1832, and a subsequent report in 1840. The systematic records now kept in various parts of the world of barometric pressure, of solar heat, of the temperature and physical conditions of the atmosphere at various altitudes, of the heat of the ground at various depths, of the rainfall, of the prevalence of winds, and the gradual elucidation not only of the laws which regulate the movements of cyclones and storms, but of the influences which are exercised by the sun and by electricity and magnetism, not only upon atmospheric conditions, but upon health and vitality, are gradually approximating meteorology to the position of an exact science. England took the lead in rainfall observations. Mr. G. J. Symons organised the British Rainfall System in 1860 with 178 observers, a system which until 1876 received the help of the British Association. Now Mr. Symons himself conducts it, assisted by more than 3,000 observers, and these volunteers not only make the observations, but defray the expenses of their reduction and publication. In foreign countries this work is done by Government officers at the public cost. At the present time a very large number of rain gauges are in daily use throughout the world. The British Islands have more than 3,000, and India and the United States have each nearly as many ; France and Germany are not far behind ; Australia probably has more—indeed, one colony alone, New South Wales, has more than 1,100. The storm warnings now issued under the excellent systematic organisation of the Meteorological Committee may be said to have had their origin in the terrible storm which broke over the Black Sea during the Crimean War on November 27th, 1855. Le Verrier traced the progress of that storm, and, seeing how its path could have been reported in advance by the electric telegraph, he proposed to establish observing stations which should report to the coasts the probability of the occurrence of a storm. Le Verrier communicated with Airy, and the Government authorised Admiral FitzRoy to make tentative

arrangements in this country. The idea was also adopted on the Continent, and now there are few civilised countries north or south of the equator without a system of storm warning. (It has often been supposed that Le Verrier was also the first to issue a daily weather map, but that was not the case, for in the Great Exhibition of 1851 the Electric Telegraph Company sold daily weather maps, copies of which are still in existence, and the data for them were, it is believed, obtained by Mr. James Glaisher, F.R.S., at that time Superintendent of the Meteorological Department at Greenwich).

The subject of Meteorology was also mentioned in Mr. Verhon Harcourt's Presidential Address to Section G. (Mechanics).

Meteorology in Relation to Engineering.—The maximum pressure that may be exerted by the wind has to be allowed for in calculating the strains which roofs, bridges, and other structures are liable to have to bear in exposed situations; and continuous records of anemometers for long periods are required for determining this pressure. The force of the wind also, and the direction, duration, and period of occurrence of severe gales, are important to the maritime engineer for estimating the effects of the waves in any special locality, for determining the quarter from which shelter is needed, and for ascertaining the seasons most suitable for the execution of harbour works, the repair of damages, and the carrying out of foundations of lighthouses and beacons on exposed rocks. The harbour engineer must, indeed, of necessity be somewhat of a meteorologist, for the changes in the wind and weather, the oscillations of the barometer, and the signs of an approaching storm are indications to him of approaching danger to his works, which he has to guard against; for the sea is an insidious enemy which soon discovers any weak spot, and may in a few hours destroy the work of months.

Continuous records of rainfall, as collected regularly by Mr. Symons from numerous stations in the United Kingdom, are extremely valuable to engineers for calculating the probable average yield of water from a given catchment area, the greatest and least discharges of a river or stream, the size of drainage channel needed to secure a low-lying area from floods, and the amount of water available for storage or irrigation in a hot, arid district. The loss of water by evaporation at different periods of the year, and under different conditions of soil and climate, the effect of percolation in reducing evaporation, and the influence of forests and vegetation in increasing the available rainfall, while equalising the flow of streams, are subjects of equal interest to hydraulic engineers and to meteorologists.

Countries periodically visited by hurricanes, cyclones, or earthquakes, necessitate special precautions, and special designs for structures; and every additional information as to the force and extent of these visitations of nature is of value in enabling engineers to provide more effectually against their ravages.

A considerable portion of the address of the Chairman of the Conference of Delegates (Mr. G. J. Symons) dealt with matters of a similar nature:—

1. *Meteorological Observations in general.*—Do not encourage the keeping of records from any but good instruments, properly placed. A hard frost occurs, and forthwith there is a crop of wonderful records, some from thermometers badly placed, some from thermometers which never were good, some from good

thermometers allowed to go wrong. An incorrect statement is much worse than none at all; see to it, then, that such records as you publish are worthy of your Society. I say no more on this head because the Royal Meteorological Society has published almost at cost price (1s.) an amply illustrated pamphlet, "Hints to Observers," which will show anyone what, and when, and how, observations ought to be made. It is by no means necessary to start with an elaborate and costly set of instruments; but see to it that the instruments which you do have are good, and that no records except from good and tested instruments, properly placed, ever appear in your volumes.

2. *Sea and river temperature.*—I have interpolated the words "and river" because I ought to have put them in the syllabus originally, and because my attention has been drawn to the subject by an excellent summary of Dr. Adolf Forster's work upon the temperatures of European rivers, by Mr. H. N. Dickson, given in the September number of *The Geographical Journal*. You will remember that for a few years there was a Committee of the British Association studying river temperature; and I am sure that if your societies took up the investigation, a fresh committee could be appointed, so that we should not need to go to a German book to learn the details of the temperature of the Thames. The work is easy, healthy, and inexpensive. Easy, because it merely involves a walk to a bridge, a jetty, or a pier head, the lowering of the thermometer into the water, entering the reading, and carrying it home again; healthy, from the regularity of the walk; and inexpensive, because the verified K. O. thermometer and its copper case, cord and everything could be sent to any part of the country complete for a sovereign.

3. *Earth temperature at shallow and at great depths.*—The second half of this subject has often been brought before you, because the Underground Temperature Committee is the oldest one of the British Association. It, as you know, deals chiefly with the temperature in mines and in deep shafts and wells. Anyone who can obtain good records at depths of, or exceeding, 1,000 feet can do useful work, but I am doubtful whether much more can be learned in this country by observations at depths between 10 feet and 1,000 feet than we already know. I insert the words "in this country," because I do not think that the law of decrease for tropical and for arctic localities is known. Unfortunately we have no representatives of such localities here, or we might sow a productive seed. Observations at shallow depths—say 3 inches to 10 feet—are becoming less rare than they were, and the time is not distant when the law of temperature variation for shallow depths will be known with sufficient accuracy. That much has yet to be ascertained, many persons learned by burst water pipes last winter. I mention this as an illustration of the application of scientific records to the welfare of mankind, not as an indication that I consider the mischief to have been wholly produced by soil temperature; but I must not digress.

4. *Phenological work.*—I am afraid that this word, phenological, has not proved very acceptable. I once heard an inquiry what meteorology had to do with prisons—and it turned out that the querist had overlooked the "h," and reading it as "penological," thought that it must have something to do with punishment. However, I need not tell you that it means the laws of the life history of plants and animals; in fact, an endeavour to record the progress of the seasons, not by thermometers or by rain gauges, but by plants, trees, insects and birds, and the study of the relations between the indications of the natural history

phenomena and those of the instruments, and efforts to separate cause and effect. It has always seemed to me a class of work peculiarly adapted for the Local Scientific Societies, for their Botanical and Entomological Sections. The Royal Meteorological Society has spent a considerable sum in promoting this work, and in the hands of Mr. E. Mawley it is progressing. Personally, I am not competent to pronounce any criticism upon the work beyond this, that Mr. Mawley has devoted himself to it, and has produced tables and diagrams of great interest. But I do say this, that I think that the naturalists should either co-operate heartily with the meteorologists, or else should show that the meteorologists are attempting the impossible or the undesirable.

5. *Early meteorological records.*—It is a prevalent idea (especially with executors) that old manuscript books of observations are useless. I have every reason to believe that a long deceased relative of my own assisted in burning part of the oldest record of the rainfall in this country—that begun at Townley in Lancashire in 1677; and what she did, at the beginning of this century, has been done by scores of others, and will be until mankind are much more thoughtful and much better informed than they yet are. But I am not addressing you in the capacity of executors, but as representatives of large local bodies, many of them with museums and libraries; and I invite you to see to it, that any such records that you have are properly cared for.

Another suggestion—The practice is fortunately rapidly spreading of publishing the early parochial registers. If each society represented here would make it a rule to go through all such publications as have been issued within its area, and print in chronological order all the notes on earthquakes, storms, frosts, floods, &c., which can be collected, much good would be done. Of course, this can be done for unpublished as well as for published records.

6. *Records of river and well levels.*—The second half of this subject has so often been brought before you by Mr. de Rance, the Secretary of the British Association Committee on Underground Water, that I need merely mention it. The first part refers to a subject involved in my next and last heading, and to which, therefore, I will at once proceed.

7. *Records of floods and the placing of flood-marks.*—It is very strange that Englishmen (Britons I had better say, for our Irish and Scotch friends are equally bad) are so nearly the worst nation in Europe for looking after their rivers. I do not refer to fouling by sewage and by manufacturing refuse, or to defective engineering—I do not know where we stand in those respects—but I refer to records of river levels, to automatic recorders of their rise and fall, to arrangements for warning the owners of low-lying property when floods are probable, to scale marks on the bridges, and to the classification, levelling, and publication in full, of particulars as to the old flood-level marks, and the due marking of new ones when floods occur. I do not suggest that your Societies should themselves do all this, but that they should bring it before their Parish and County Councils, and couple their request with the offer of any assistance in their power. Of course the suggestion will be received politely, the great cost will be urged, and in many cases nothing will be done. Forgive my detaining you to hear a little true story. Years ago I suggested such arrangements to an influential man in York—nothing was done. In 1892 York had a flood, not so bad as some on record, but one which cost

the Corporation a very large sum; they paid it, and, that steed having been stolen, they have figuratively locked the stable door, by adopting every one of the arrangements suggested above. If the Councils do not take your advice, they must remember that your attendance will be on their Minutes, to be referred to when their town or district suffers as York did.

REPORT ON UNDERGROUND TEMPERATURE.

Professor J. D. Everett read this report, which contains a description of temperature observations made in a bore-hole at Cremorne, near Port Jackson, New South Wales. The hole is 2,929 ft. deep, and showed a temperature gradient of 1° F. in 80 ft. This being smaller than the average, it might be thought that the proximity of Sydney Harbour was affecting the distribution of temperature. Observations on the water of the harbour showed, however, that the gradient was less than in the bore-hole. This was the first observation in the Southern Hemisphere.

Lord Kelvin suggested that the African mines might furnish a new field for future observations of underground temperature.

REPORT ON SOLAR RADIATION.

The Committee which was appointed some time ago to consider the best methods of recording the direct intensity of solar radiation, reported that for various reasons no experiments had been made with the Balfour Stewart actinometer since the last meeting of the Association. As Mr. W. E. Wilson had undertaken to continue the experiments, the Committee asked for re-appointment, and the unexpended balance of the previous grant.

REPORT ON EARTH TREMORS.

Mr. G. J. Symons read this report. During the year two bifilar pendulums have been purchased from the Cambridge Instrument Company, similar to those with which experiments were made in 1893 and described in the report for that year. Several modifications have, however, been made, such as were mentioned in last year's report. Each pendulum has a photographic recording apparatus. The committee hope to compare the records of the two instruments during the coming year. An appendix to the report, by the secretary (Mr. C. Davison) gives the history and bibliography of the horizontal and bifilar pendulums. These he groups into three classes—(1) those in which the rod or mirror is suspended by two wires, the centre of gravity of the rod or mirror lying either (*a*) between the points of attachment of the suspending wires or (*b*) outside them; (2) those in which the rod is supported by one wire and one steel point; (3) the pendulum of Rebeur-Paschwitz, which is supported on two steel points. Mr. Symons said the instruments could detect a tilt of the earth through an angle equal to that between two straight lines diverging from each other by only one inch in 1,000 miles. They are quite unaffected by short-period movements such as are produced by ordinary street traffic. The object was not merely to record distant earthquakes or tremors, but also to record any tilting in the earth's surface, with the ultimate view of determining whether this tilting was caused by tidal waves, large changes and disturbances of atmospheric pressure, or other agencies.

REPORT ON THE APPLICATION OF PHOTOGRAPHY TO METEOROLOGY.

Mr. G. J. Symons presented the report from this Committee, and gave an interesting account of what Mr. Clayden, the secretary, had done in the direction of cloud photography, and explained that, although it would be some time before they could hope to get any considerable number of photographs, the cameras for this purpose had been purchased and electrically connected, and little more was now required beyond the necessary time and attention. Mr. Symons handed round a photograph of a rainbow—the first of the kind that he had seen—which had been sent to him with the following letter :—

"Steeple Croft, Coventry.

"Dear Sir,—At the meeting of British Association a couple of years ago, I promised to obtain for you, if possible, some photographs of lightning; but circumstances have not been favourable. I send you, however, a couple of prints from negatives of a rainbow recently taken. It was, I think, the finest bow I have ever seen. One marked peculiarity was the brighter or lighter colour of the cloud inside the bow, and this is clearly shown in the photograph. Another peculiarity was that the green and violet seemed to be duplicated or triplicated inside the bow, and the albumenised print shows some traces of this. The outer bow is also visible in the prints. The lens I used was a symmetrical doublet, four inches focal length, exposure three seconds.—Yours, &c.,

"WILLIAM ANDREWS, F.G.S."

Professor Schuster said it was a most interesting and beautiful photograph, showing how the inside of the rainbow was much brighter than the outside. It was also an instructive photograph, as a means of showing students what we had been teaching them without being able to prove to them.

REPORT ON METEOROLOGICAL OBSERVATIONS ON BEN NEVIS.

Extracts from this report were read by the Secretary. The hourly eye observations by night as well as by day have been made without interruption during the year on Ben Nevis, and continuous records have been made at Fort William low-level observatory. Rainband observations are inserted in the report for the first time, as are also the records of mean hourly velocity of the wind at the top of the mountain. At Fort William the mean temperature of the year was 0°·8 higher than the mean of previous years, while the top of the mountain was 0°·9 higher than the mean. The lowest mean monthly temperatures were in January, 39°·3 at Fort William and 21°·7 on the summit. The former is 0°·7 above, the latter 2°·1 below, the average; so that during the month there existed a large difference of temperature between the two places, attributable to absence of anticyclonic weather and a great want of sunshine, the total sunshine registered on the top of the mountain being only three hours for the whole month. In September and October, on the other hand, maxima of sunshine were recorded. The highest mean temperatures were reached in July at both observatories. November showed the greatest excess of temperature above the average of past years, amounting to 4°·1 at the bottom and 3°·2 at the top of the mountain. The cause is to be found in the south-westerly

winds which predominated to a greater extent than for the past 40 years. The coldest day was January 6th, the lowest temperature recorded being 0°·7 at the top and 20°·8 at Fort William. Details of the observations and weather of this day are given in the report. Much work has been done in re-copying the observations at the two observatories in order to examine the bearings of the differences of readings on the meteorology of North-Western Europe. This work is being carried on by Dr. Buchan and Mr. Omond; among the chief phenomena considered are cyclones and anticyclones, differences of temperature and wind between the two stations, especially occasions when the temperature was higher on the top than at the sea-level, and days when the difference of temperature greatly exceeded the normal amount. An inquiry into the connexion of these occurrences with coming storms and with each other will, it is hoped, lead to valuable results; it already points to the necessity for most important modifications in the present theory of cyclones held by meteorologists. Four tables are added to the report, showing the mean hourly variations of pressure at Magdeburg and San José on fine and cloudy days respectively. These two stations are chosen because Magdeburg has a dry climate contrasting with the wet one of Ben Nevis, and San José, at about the same height above the sea as the top of the Ben, is only 10 deg. from the equator. The characteristically low morning maximum and the very high evening maximum during cloudy days at Ben Nevis and Magdeburg, in all seasons, do not occur at San José in similar weather. The two daily minima do, however, occur there, the morning one being larger on cloudy than on sunny days, and the afternoon one less.

REPORT ON EARTHQUAKES IN JAPAN.

Prof. John Milne gave an account of the long report of the Committee on Seismological Phenomena in Japan. This commences by a reference to the great loss caused by the recent fire at Prof. Milne's house and observatory, after which follows a description of the records of the Gray-Milne seismograph. Attached to the report is a catalogue of 8,331 earthquake shocks recorded in Japan between 1885 and 1892, giving full particulars of the centre and area of disturbance. It enables the approximate *weight* of each to be found, and permits the division of Japan into fifteen distinct seismic districts. The next section of the report deals with the rate of propagation of earthquake disturbances from Japan to Europe. The small tremors which occur in the ten seconds or so before an earthquake shock are transmitted to Europe, but they are spread over half an hour; it appears, therefore, that the preliminary tremors either travel more quickly, or reach Europe by a shorter route than the main shock. The latter is known to travel along the surface at about 3,000 metres per second. Do the tremors travel at 8,000 to 11,000 metres per second, or do they pass through the earth, not round it? If the latter, we may hope for some further knowledge concerning the interior of the globe. Prof. Milne has set up horizontal pendulums in nearly a score of places, and finds great differences in their behaviour. They all exhibit a general displacement, *i.e.*, tilt, in the same direction, and similar long-period movements. Examined from hour to hour, however, some of them show the existence of a diurnal wave. After a long and very laborious search, graphically described to the Section by Prof. Milne, he succeeded in tracing this diurnal effect to the local removal of load from the

alluvium by greater evaporation from exposed areas. At night the movement is slight, and is probably accounted for by the condensation, at the cold surface, of aqueous vapour after rising through the warm earth. Some observations have been made on the disturbance of the pendulums by earth tremors. Their cause has not been ascertained, but they always occur with greatest intensity between 5 and 9 a.m. They are most marked with a steep barometer gradient and consequent wind, local or distant.

Lord Kelvin said it was possible to determine mathematically the time of arrival of the first earthquake shock reaching any point from any other point. Such calculations would, however, tell us nothing about the rigidity of the interior of the earth.

Prof. Gray referred to the enormous loss sustained by Prof. Milne in the burning of his books and instruments. He hoped the Association would make a grant enabling Prof. Milne to continue his work.

As Prof. Milne has now returned from Japan, and the earthquake catalogue is completed, the Committees on Earth Tremors and Seismological Phenomena have united under the latter name. The new Committee is a large one, and with Prof. Milne and Mr. Davison as joint secretaries, it ought to do good work.

REPORT OF THE COMMITTEE ON UNDERGROUND WATERS.

This was read by Mr. C. E. De Rance, the Secretary, who has practically done all the work for many years. We have not a full note of the report, but understand that it was the final one, and that arrangements are proceeding with a view to the publication of a volume giving a synopsis of the large mass of data as to wells and their yield in all parts of the country.

REPORT ON COSMIC DUST.

Dr. John Murray said that at the bottom of the Pacific Ocean, 1,000 miles from any coast, the red clay deposits contain three classes of magnetic particles. These are (1) crystalline fragments of magnetic or titanic iron; (2) dark, shiny spherules; and (3) brownish spherules, known as chondres. The dark spherules contain iron particles which, when the spherule is ground down, become coated with copper if treated with a solution of copper sulphate. They are probably volcanic, and of terrestrial origin. The brown spherules are extra-terrestrial. They occur in the various layers of manganese nodules, along with the black spherules, but they are not found except at the place mentioned in the Pacific Ocean. They have been looked for in many places, but without success. Most probably they are hidden by the presence of other matter, as their amount is very small, say, about 20lb per square mile per century. He wanted advice as to the best means of procedure, in order to collect this dust in other parts of the globe.

In reply to Lord Kelvin and Professor Fitzgerald, Dr. Murray said that the dust from Ben Nevis and the Greenland glaciers contained no cosmic matter.

The following were the ordinary papers which dealt with meteorological subjects:—

E. S. Bruce—*On Probable Projective Lightning Flashes.*

The object of this paper was to suggest the possibility of projective lightning flashes, whose existence would increase the difficulties of classification. Ordi-

nary sheet lightning is the reflection of a lightning flash by a cloud, images from different points being superposed. If, however, a cloud intervenes between the flash and the reflecting cloud, containing one or more openings, the light from the flash will be faintly reflected from a few points only of the reflecting cloud, and we shall have as many inverted images of the flash as there are openings. If the reflecting cloud is of irregular shape the images will be distorted, and a straight flash may appear to possess angles. This was illustrated by lantern slides and experiments, a drawing of an actual thundercloud with four apertures being exhibited. He doubted whether such reflected flashes would be intense enough to affect a photographic plate.

Mr. G. J. Symons thought there should be a patch of brighter light at the angle of a reflected flash, if formed in the manner suggested by Mr. Bruce, and he failed to see the parallelism between the experimental conditions and those of nature.

Mr. Bruce, who was thanked for the manner in which he had brought so interesting a subject before the meeting, contended that he had conclusively proved the possibility of a projection lightning flash.

(To be concluded in our next.)

SALT HAIL.

IN the *Met. Mag.*, vol. xxiv. (1889), p. 105, occurred the following lines :—

"Mr. W. Rogers, of Ensfield Farm, Tunbridge, was walking over his farm, accompanied by his dog. The dog, seeing the large hailstones hopping about as they fell, ran after them, and began to eat some. This led Mr. Rogers to taste them, and he found that they all tasted of salt." The statement was (in subsequent numbers) ridiculed by Mr. R. J. Lecky, and discredited by the Rev. J. Slatter, but supported by Dr. Muirhead and by Dr. Burder, who, having exposed a slip of glass to catch Krakatoa dust, found, where a hailstone had melted, chloride of sodium.

We have just noticed, in the *Jamaica Weather Review* for June, 1895, the following report :—

"VALE ROYAL. (*H. F. Kilburn*).—On the afternoon of June 6th, "between 3 and 4 p.m., there was a remarkably heavy fall of hail at "Vale Royal. It lasted fully half an hour. The stones were the "largest I had ever seen, being about $\frac{3}{4}$ inch diameter. On tasting "a couple, I found that they were quite salt. Nobody on the "Estate can tell me of hail ever having fallen here before."

RAINFALL IN PALESTINE IN THE SECOND CENTURY.

DR. HERMANN VOGELSTEIN took, for the subject of his Diplôma Dissertation, "Agriculture in Palestine in the time of the Mishnah. Part I. The Cultivation of Corn." (Published at Breslau, 1894).

In the *Zeitschrift* for April, 1895, Dr. Hann gives an account of that portion of Dr. Vogelstein's dissertation which refers to rainfall. It is of such interest that we believe that a free translation will be generally acceptable.

Dr. Vogelstein gives an account of agriculture in Palestine in the first two centuries of the Christian era, based upon the records of the Mishnah, Tosefta, &c.

The Mishnah distinguishes two seasons, the time of the rains and the time of drought. In average years the early rains fell soon after the autumnal equinox. The great importance of these rains, as governing the fertility of the land, is repeatedly indicated both in the Bible and in the Mishnah. During the normal season for rain, daily prayers were offered for it. When rain did not fall at the usual dates, fast-days and prayer days were appointed, which of course indicate periods of drought. The recognition of the importance of rain to agriculture had (even in the time of the Mishnah) led to fairly accurate measurements and observations. The depth of rain was measured in a vessel. There should, in the first, second, and third period of the early rains, fall respectively 1, 2, and 3 Tefahs = about $3\frac{1}{2}$, 7, and $10\frac{1}{2}$ inches. In the second period there should be seven consecutive days of rain.

The early rains were important for the sowing, the later rains, in Nisan (March and April) for the harvest. The change from the rainy period, in which also hailstorms destructive to the springing crops were not rare, to the dry season was gradual. The rains diminished, and finally ceased. In the dry season, rain or a thunderstorm was extremely rare, but the dew was excessive, so that in the morning the ground was as wet as if rain had fallen; this was the only refreshment for the thirsty earth, and therefore of the greatest importance to the growing crops.

So far, Dr. Vogelstein and the Mishnah. The rainfall was therefore regularly measured in Palestine in the first century after Christ, and the average for the early rains was estimated at about 6 Tefahs, or 21 inches, which agrees fairly well with modern records—for instance, with that at Jerusalem. Perhaps Dr. Vogelstein may yet find a record of the total yearly fall of rain in Palestine in the first century of the Christian era.

Since the above was in type we have been favoured by Dr. Hann with a copy of Dr. Vogelstein's Dissertation (82 pp., German, but with a mass of Hebrew, Syriac, Arabic, Greek and Latin notes). We have also received some important papers from Dr. Chaplin, who took daily observations in Jerusalem from 1860 to 1882. We therefore hope to return to the subject at an early date.

BELGIAN RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—It was by an inexplicable error, the origin of which I cannot trace, that I wrote "Deux pluviomètres conjugués ont constamment servi aux observations." The fact is that the gauges represented on p. 102 of the *Met. Mag.* were used from 1833 to 1854, and not from 1833 to 1866, as you supposed. The gauges by which in 1855 they were supplanted were observed uninterruptedly at Brussels until 1890, and others of the same pattern are in use at Uccle.

Comparisons of the two systems were made by Quetelet during 22 months (Annales xi., p. 273). The original gauges were of tin, and they were abandoned because the rust on their surface caused (towards the end of their existence) greater loss than usual from retarded flow of the water into the receivers.

The mean by the old gauges (1833-54) was 724 mm. (28·50 in.); the mean of the subsequent 22 years (1855-76) by the new ones was 695 mm. (27·36 in.)

These contradict your argument on p. 103, in which you did not call attention to the dryness of the period, 1857-65, over the whole of Western Europe, which sufficiently explains the difference between the periods 1833-66 and 1867-90.

I am sure that the observations from 1833 to the present time are *strictly comparable*, and that the differences are due to secular variation alone.

The details as to the pattern, &c., of gauges are intentionally reserved for a later part of the work.

Observations made in the same town are usually placed in one series, unless two or more records were kept simultaneously, then necessarily they are separated. By exception, the early records for Brussels are separated from the Observatory observations, in order that the full value of the latter should in no way be impaired.

I was entirely unaware that Prof. Raulin had adopted the method of typographically indicating the length of series of observations. We have, therefore, independently arrived at the same plan.

Yours truly,

A. LANCASTER.

Uccle, October 2nd, 1895.

[Considering the opening sentence of the above, it would not be courteous for us to pursue the subject, but we really cannot pass the words which we have put in italics. Uccle is nearly 4 miles from the old Observatory, and more than 100 feet higher. The mean for 5 years (1886-90) was at Uccle 711 mm. (27·99 in.), and for the same years at the old Observatory, 760 mm. (29·92 in.), an excess of nearly seven per cent. How can these be regarded as strictly comparable?

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	63·7	22	23·7	3	51·0	35·6	37·6	84	102·6	22·4	1·42	14	6·9
Malta	81·6	30	41·8	20	63·9	49·4	47·3	76	132·5	36·3	·80	9	4·5
Mauritius	85·0	6,7	70·1	19	81·9	74·1	71·3	81	134·1	66·3	24·11	26	7·4
Calcutta	97·5	29	59·2	21	91·3	68·7	65·2	65	153·9	53·0	·18	1	2·0
Bombay	89·3	6	71·0	26	86·1	73·9	70·5	73	138·5	61·2	·00	0	1·3
Ceylon, Colombo	91·0	...	71·8	...	89·0	75·4	71·7	74	147·5	63·0	1·84	13	2·8
Melbourne	95·0	13	46·0	21	73·4	54·8	52·9	70	142·6	36·1	1·80	8	5·5
Adelaide	100·5	12	50·7	30	80·5	58·8	51·9	53	155·3	43·0	1·79	9	3·9
Sydney	83·2	17	55·3	20	74·6	63·2	61·0	75	145·9	44·6	1·46	13	4·1
Wellington	71·0	19	43·0	23	66·2	53·6	50·2	70	132·0	27·0	2·40	10	4·6
Auckland	75·0	18	52·0	28	70·6	58·0	54·6	71	140·0	48·0	1·91	14	4·8
Jamaica, Kingston	90·2	29	64·0	4	85·4	67·9	66·8	78	...	...	·43	6	3·5
Trinidad	91·0	20	64·0	19*a*	86·9	67·3	68·0	76	170·0	62·0	2·27	14	...
Toronto	49·9	24	—1·6	14	32·5	15·7	19·2	75	...	—3·0	·93	18	5·0
New Brunswick, Fredericton	47·3	25	—8·7	12	33·8	11·9	18·6	69	...	...	2·16	·12	4·6
Manitoba, Winnipeg	49·0	31	—32·5	13	26·6	1·30	...	...	...	...	·55	11	4·9
British Columbia, Esquimalt	58·6	27	25·7	14	50·1	35·9	28·6	86	...	...	1·38	19	6·1

a—and 31.

REMARKS.

MALTA.—Adopted mean temp. (55°·0), 0°·9 below the average. Mean hourly velocity of wind 11·8 miles. Average sea temp. 59°·0. Thunderstorm on 27th. Lightning on 6th and 20th. Hail on 6th and 7th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·1 above, of dew point 1°·4 above, and rainfall 15·38 in. above their respective averages. Mean hourly velocity of wind 11·7 miles, or 1·7 mile above average; extremes, 25·5 miles on 18th and 2·1 on 5th; prevailing direction, E.S.E. to E.N.E. Thunder and Lightning on 5 days. An unusually wet month, the rainfall in different parts of the island being from 21 to 50 inches. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 6 days, and lightning was seen on 8 other days. D. G. MANTELL.

Adelaide.—Mean temp. 0°·9 below the average of 38 years. Rainfall ·75 in. above the average. C. TODD, F.R.S.

Sydney.—Mean temp. 0°·3 below, humidity 1°·3 and rainfall 4·04 in. below their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Showery at the beginning of the month; dry, but generally unpleasant from the 4th to the 20th, with strong N.W. winds; from 21st to the end showery, with intervals of fine weather. Thunder on 23rd. Mean temp. 2°·2 and rainfall 1·14 in. below the average. R. B. GORE.

AUCKLAND.—A dry month with little of importance to report. Mean temp. and rainfall both below the average of 28 years. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Hourly velocity of wind 4·2 miles. Kingston rainfall one-third, and island rainfall two-thirds, of the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·40 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall .	·63	XI.	Lake Vyrnwy	3·22
,,	Birchington, Thor	·79	,,	Corwen, Rhug	·48
,,	Hailsham	·76	,,	Carnarvon, Cocksidia ...	1·50
,,	Ryde, Thornbrough	·46	,,	I. of Man, Douglas	·86
,,	Emsworth, Redlands ...	·84	XII.	Stoneykirk, Ardwell Ho.	·63
,,	Alton, Ashdell	·98	,,	New Galloway, Glenlee	1·21
III.	Oxford, Magdalen Col..	·64	,,	Melrose, Abbey Gate...	...
,,	Banbury, Bloxham	·94	XIII.	N. Esk Res. [Penicuick]	1·35
,,	Northampton, Sedgebrook	·64	,,	Edinburgh, Blacket Pl..	·63
,,	Alconbury	·47	XIV.	Glasgow, Queen's Park..	1·40
,,	Wisbech, Bank House...	·57	XV.	Inverary, Newtown	4·43
IV.	Southend	·89	,,	Islay, Gruinart Schools..	1·99
,,	Harlow, Sheering..... ...	·86	XVI.	Dollar.....	2·53
,,	Colchester, Lexden	1·26	,,	Balquhidder, Stronvar...	2·94
,,	Rendlesham Hall	·93	,,	Ballinluig	1·34
,,	Diss	·56	,,	Dalnaspidal H.R.S.....	2·57
,,	Swaffham	·61	XVII.	Keith H.R.S.....	1·98
V.	Salisbury, Alderbury ...	1·41	,,	Forres H.R.S.	1·59
,,	Bishop's Cannings	1·30	XVIII.	Fearn, Lower Pitkerrie..	1·36
,,	Blandford, Whatcombe .	·39	,,	Loch Shiel, Glenaladale	...
,,	Ashburton, Holne Vic...	·61	,,	N. Uist, Loch Maddy ...	3·66
,,	Okehampton, Oaklands.	1·53	,,	Invergarry.....	4·48
,,	Hartland Abbey	·66	,,	Aviemore H.R.S.	2·25
,,	Lynmouth, Glenthorne.	1·16	,,	Loch Ness, Drumnadrochit	2·27
,,	Probus, Lamellyn	·29	XIX.	Invershin	1·42
,,	Wellington, Sunnyside..	...	,,	Scourie	2·39
,,	Wincanton, Stowell Rec.	·67	,,	Watten H.R.S.....	1·62
VI.	Clifton, Pembroke Road	1·22	XX.	Dunmanway, Coolkelure	2·25
,,	Ross, The Graig	1·01	,,	Fermoy Gas Works	...
,,	Wem, Clive Vicarage ...	·93	,,	Killarney, Woodlawn ...	1·09
,,	Cheadle, The Heath Ho.	·74	,,	Caher, Duneske	1·19
,,	Worcester, Diglis Lock	·29	,,	Ballingarry, Hazelfort...	·54
,,	Coventry, Coundon	1·00	,,	Limerick, Kilcornan ...	1·33
VII.	Ketton Hall [Stamford]	·72	,,	Ennis	...
,,	Grantham, Stainby	·70	,,	Miltown Malbay	1·07
,,	Horncastle, Bucknall ...	·27	XXI.	Gorey, Courtown House	1·48
,,	Worksop, Hodsck Priory	·97	,,	Athlone, Twyford	·55
VIII.	Neston, Hinderton	1·05	,,	Mullingar, Belvedere ...	·20
,,	Preston, Haighton	1·70	,,	Longford, Currygrane...	·38
,,	Broughton-in-Furness ...	1·77	XXII.	Woodlawn	1·30
IX.	Ripon, Mickley.....	1·41	,,	Crossmolina, Enniscoe ..	1·88
,,	Melmerly, Baldersby ...	1·08	,,	Collooney, Markree Obs.	1·16
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton ...	·73	XXIII.	Lough Sheelin, Arley...	·37
X.	Haltwhistle, Unthank...	·99	,,	Warrenpoint.....	·48
,,	Bamburgh	·30	,,	Seaforde..	·38
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	·60
XI.	Llanfrechfa Grange	1·53	,,	Bushmills, Dundarave..	·88
,,	Llandovery	1·17	,,	Stewartstown	·55
,,	Castle Malgwyn	·61	,,	Buncrana	1·14
,,	Builth, Abergwessin Vic.	1·51	,,	Lough Swilly, Carrablagh.	1·86
,,	Rhayader, Nantgwillt...	1·05			

SEPTEMBER, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Da
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	1·28	— 1·23	1·24	6	2	82·8	24	42·6	2
II.		Maidstone (Hunton Court)...	·35	— 2·24	·25	10	2	...	...	...	..
,,		Strathfield Turgiss	2·15	— ·30	1·78	6	6	87·0	25*a*	38·4	1
III.		Hitchin	·92	— 1·58	·84	6	5	82·0	24*a*	34·0	2
,,		Winslow (Addington)	·69	— 1·98	·61	6	5	85·0	24	33·0	2
IV.		Bury St. Edmunds (Westley)	·58	— 2·12	·53	6	3	74·0	2, 26	42·0	2
,,		Norwich (Brundall)	·46	...	·41	6	3	81·0	2	38·2	2
V.		Weymouth(LangtonHerring)	·54	— 1·88	·27	6	4	75·0	26	46·0	2
,,		Torquay (Cary Green)	·28	...	·27	30	2	73·9	28	45·4	1
,,		Polapit Tamar [Launceston]..	·66	— 3·05	·29	10	10	81·8	9	34·7	2
VI.		Stroud (Upfield)	·98	— 1·93	·50	6	10	79·0	9	44·0	2
,,		ChurchStretton(Woolstaston)	1·08	— 1·42	·27	5	10	80·0	24*a*	41·0	2
,,		Tenbury (Orleton)	·70	— 1·91	·29	24	7	82·1	24	33·0	2
VII.		Leicester (Barkby)	·44	— 2·20	·22	6	6	82·0	24*a*	30·0	2
,,		Boston	·48	— 2·29	·37	6	3	84·0	26	40·0	2
,,		Hesley Hall [Tickhill].....	·78	— 1·38	·45	6	6	84·0	2	33·0	2
VIII.		Manchester(PlymouthGrove)	1·44	— 2·03	·80	6	6	84·0	28	43·0	2
IX.		Wetherby (Ribston Hall) ...	·97	— 1·49	·34	7	5	...	...	...	..
,,		Skipton (Arncliffe)	3·00	— 1·76	1·21	11	10	..	...	...	..
,,		Hull (Pearson Park).	1·08	— 1·36	·47	6	7	78·0	2, 9	35·0	2
X.		Newcastle (Town Moor)	·44	— 2·34	·21	3	5	...	...	...	..
,,		Borrowdale (Seathwaite).....	5·35	— 6·38	1·61	11	14	...	...	...	..
XI.	WALES.	Cardiff (Ely).....	1·29	— 2·45	·49	6	9	...	...	...	..
,,		Haverfordwest	·98	— 3·42	·42	4	10	77·4	28	37·2	2
,,		Aberystwith (Gogerddan) ...	1·70	— 2·57	·44	4	7	85·0	28	30·0	2
,,		Llandudno.....	1·24	— ·98	·84	4	7	84·0	9	47·0	2
XII.	SCOTLAND.	Cargen [Dumfries]	·22	— 3·34	·14	2	3	79·0	28	36·6	2
,,		Jedburgh (Sunnyside).....	·29	— 2·40	·10	17	6	84·0	9, 13	37·0	2
XIV.		Colmonell	·60	...	·17	17	7	81·0	27	36·0	1
XV.		Lochgilphead (Kilmory).....	3·04	— 2·69	1·10	10	11	...	...	39·0	1
,,		Mull (Quinish).....	5·42	+ ·39	1·26	16	20	...	...	...	..
XVI.		Loch Leven Sluices	1·10	— 1·69	·40	17	6	...	...	...	..
,,		Dundee (Eastern Necropolis)	·80	— 1·71	·45	16	10	74·1	25	38·8	2
XVII.		Braemar	1·89	— ·97	·61	16	12	73·2	29	34·0	(
,,		Aberdeen (Cranford)	1·44	...	·45	16	14	74·0	25*a*	36·0	2
XVIII.		Strathconan [Beanly]	3·25	— ·43	·70	12*f*	10	...	...	...	..
,,		Glencarron Lodge.....	6·41	...	1·07	17	19	77·1	9	39·0	(
,,		Cawdor [Nairn]	1·76	— ·99	·80	17	11	...	...	...	..
XIX.		Dunrobin	...	...	...	...	...	...	...	...	..
,,		S. Ronaldsay (Roeberry).....	2·23	— ·43	·37	17	17	67·0	27	45·0	1
XX.	IRELAND.	Darrynane Abbey.....	·88	...	·32	4	10	...	...	...	..
,,		Waterford (Brook Lodge) ...	2·08	— ·84	·82	4	9	75·0	28	40·0	1
,,		O'Briensbridge (Ross)	1·49	...	·41	10	7	...	...	...	..
XXI.		Carlow (Browne's Hill)	1·10	— 1·72	·38	4	8	...	...	...	..
,,		Dublin (FitzWilliam Square)	·54	— 1·43	·18	2, 4	7	72·0	2	43·0	2
XXII.		Ballinasloe	·57	— 2·22	·34	10	7	84·0	26	35·0	2
,,		Clifden (Kylemore)	2·31	...	1·00	10	9	...	...	...	..
XXIII		Waringstown	·29	— 2·87	·14	11	5	81·0	27	38·0	..
,,		Londonderry (Creggan Res.).	1·53	— 2·25	·52	2	11	...	...	...	..
,,		Omagh (Edenfel).....	·76	— 2·62	·24	10	7	75·0	29	36·0	2

+Shows that the fall was above the average ; —that it was below it.

a—and 27. *b*—and 21, 22. c—and 21. *d*—and 22. *e*—and 23. f—and 18. g—

METEOROLOGICAL NOTES ON SEPTEMBER, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—Very fine and dry until the night of the 6th, when a very heavy TS passed over, after which hot weather returned and continued until the end of the month, with a slight TS on the 24th. During the last fortnight the max. temp. was the highest in September since the record began in 1875.

ADDINGTON.—This September has given us the least rainfall and the highest temp. of any September recorded here. The max. temp. was 70° and upwards on 17 days, 80° and upwards on 6 days, the last 8 days having an average max. of 80°. The night temp. was with a few exceptions high, and on three nights a minimum of 60° was recorded. Violent TS at 3 a.m. on 7th.

BURY ST. EDMUNDS, WESTLEY.—The driest September since 1865, when the fall was ·11 in. The drought was accompanied by great heat and much sunshine, many days being without a cloud. TS on 6th, distant T on 3rd and 10th.

NORWICH, BRUNDALL.—Probably the finest, warmest and driest September since 1865. The last week was abnormally warm. A similar week at the end of September seems, according to old MSS. in my possession, to have occurred in East Anglia in 1832. Distant TS on 3rd; TS 5.45 to 6.45 a.m. on 7th.

LANGTON HERRING.—The driest September in the last 24 years. A warm month with many cloudless days. The average min. (54°·4) is 3°·2, and the average max. (67°·9) 4° above the average of 23 years. The temp. throughout was equal to that of the preceeding July and higher than that of August. The last week of the month was the hottest in the year, with an average temp. of 66°·2. On ten days the temp. rose to 70° or above. T and L on the 3rd, 4th, 7th, 24th, 26th and 30th. Fogs on the 6th and 25th.

TORQUAY, CARY GREEN.—Rainfall 2·06 in. below the average. Mean temp. 60°·9, or 3°·1 above the average. Duration of sunshine 213 hours 45 minutes, or 49 hours 20 minutes above the average; one sunless day.

POLAPIT TAMAR.—A most memorable month; remarkable for absence of strong breezes, for excessive heat, and for the exceptionally small quantity of R, the smallest in September since 1880. The rainfall for the first 9 months of 1895 is only 18·19 in., or less than half the annual average (37·36 in.) The average max. shade temp. was very high, 71°·5. Heavy TS at midnight on 6th.

STROUD, UPFIELD.—TSS to the E. on 3rd, E. and S.E. on 6th, and to the W. on 24th; L on 23rd. Max. temp. above 70° from 23rd to 30th inclusive.

WOOLSTASTON.—A very hot and dry month, the heat during the last fortnight especially being most intense. Fruit-bearing trees of all kinds produced enormous crops, but the want of water was greatly felt. Mean temp. 60°·1.

TENBURY, ORLETON.—The hottest and, with the single exception of September, 1888, the driest September since 1865. The mean temp. of the month was 60°·0, or 3°·2 above the average of 34 years, and was nearly 2° lower than that of 1865; but the mean max. was nearly 1° higher than in that year, and the thermometer reached 70° on 22 days, as against 21 in that year. The hottest weather too was in the last week of the month, whereas in 1865 the last week was cold. Brilliant sunshine prevailed through the whole month. T on the 3rd and 24th. L on 3rd, 23rd and 24th. Fog on 12 days.

LEICESTER, BARKBY.—Remarkable for great heat and drought. The mean max. temp. is the highest for the year. Streams, wells and pits are dry all round the district, and the scarcity of water is great and serious. Mean max. temp. 73°·8. Mean min. 44°·8. Mean 59°·3. Fortunately the Borough of Leicester has an additional water supply this year. L, T and H on 3rd. L on 24th.

HULL, PEARSON PARK.—TS on 3rd. Fog on 14th and 16th, and daily from 22nd to 30th, excepting the 24th.

WALES.

HAVERFORDWEST.—The first 9 days were more or less wet, after which a fine, hot, almost cloudless condition set in, much haze rendering the distant landscape invisible for nearly a fortnight. The temp. was above 70° on eight days, seven of which occurred in the last week. The fine weather enabled the harvest to be gathered in in fine condition, and such a superabundance of grass has seldom been seen at this season of the year. One of the driest Septembers on record, and the warmest.

SCOTLAND.

CARGEN.—This month still further adds to the remarkable meteorological phenomena of 1895. Although the mean temp. has been twice exceeded during 36 years, the average temp. of the last seven days (63°·5) is unprecedented in September. On ten days the max. exceeded 70°. The max. temp. of the month (79° on the 28th) has only once been exceeded (80°·4 on September 4th, 1880), and once equalled. The high mean pressure is also noticeable, while the number of hours of sunshine exceeds the average by 54. Wind force slight and southerly winds prevalent. The rainfall has only once been less in September, and only on three occasions in any month. Unusually heavy dews made up for the absence of R, and pastures were never more luxuriant at this season. The effects of the warm weather are seen in the enlargement of the buds of bush fruit and flowering trees, and several species of rhododendron blossomed a second time.

JEDBURGH.—The temperature was higher than in any September for 30 years. The grain crops have been secured in good condition, and potatoes are a full crop and free from disease. Tree fruit abundant and excellent. The temp. on 12 days was above 70°. A good deal of fog before 9 a.m. Rainfall the smallest in any month since March, 1865, when ·17 in. fell.

COLMONELL—Rainfall 3·56 in. below the average of 19 years. T and L on 9th.

ABERDEEN, CRANFORD.—A very warm month, with winds from S.W. and W., and very light. Crops all cut about Aberdeen.

ROEBERRY.—The first part wet, the latter warm and foggy. Mean temp. 55°·3.

IRELAND.

DARRYNANE.—A very fine and warm month.

O'BRIENSBRIDGE, ROSS.—Fine average harvest weather for the first three weeks. On the night of the 23rd a violent storm of T and L set in at 8 p.m., and continued for three hours, followed next day by an extraordinary rise in temperature, and for 6 days the heat far exceeded that of midsummer.

DUBLIN.—As in both 1893 and 1894, September proved a favourable month. The heat was tempered by a sea breeze but the sunshine was above the average, and the mean amount of cloud was only 4·2. Towards the close of the month heavy dews and dense night fogs became very prevalent. Mean temp. 59°·1, or 3°·3 above the average. High winds occurred on 7 days, and attained the force of a gale on the 10th and 11th. L on the 23rd.

WARINGSTOWN.—A remarkable September, the warmest since 1865. Max. in 1865, 82°; in 1895, 81°. Mean, 1865, 59°·7; 1895, 58°·5. Mean for the 14 years, 1861 to 1874, 54°·3. A magnificent harvest was secured in prime condition.

EDENFEL, OMAGH.—Another remarkable September, with the smallest rainfall except 1894, and much the highest temp. for at least 31 years; indeed, during that period a max. temp. of 70° has been only twice reached in the latter half of September, viz., 71° on 19th September, 1881, and 70° on 17th September, 1883, while during the last week of the past month the max. ranged from 75° to 70° on five days, and on the night of the 25th the minimum was the highest of the year, 61°. Coming after the wet August, vegetation has been phenomenal. The autumn tints have hardly touched the trees, and it was only on October 4th that the extraordinary change ushered in by October seemed to have re-awakened the migratory instincts of the swallows from their "midsummer night's dream."

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THE OBSERVATORY:

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(Savilian Professor of Astronomy.)

T. LEWIS, F.R.A.S., AND H. P. HOLLIS, B.A., F.R.A.S.

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SYMONS'S
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SEPTEMBER, 1895.

THE very exceptional weather of September was occasioned by the persistence of anti-cyclonic conditions over Western Europe. In the early part of the month the centre of the high pressure area was well to the east of France, and irregular distribution of pressure over the British Isles on the 5th and 6th produced thunderstorms and rain very generally. On the 11th and 12th a depression passed across the North of Scotland, and falls of rain exceeding an inch occurred at many stations. From the 13th to 17th the centre of high pressure lay over England, but on the 18th, a cyclone coming in from the Atlantic apparently forced it eastwards. From the 19th to 21st the centre again extended to England, but thence to the end of the month, during the period of great heat, it was to eastward, but generally extending well to the north.

RAINFALL.

That the rainfall for the month was generally very small is clearly shown by the regular table on p. 146, where we find only one plus sign (at a station on the west coast of Scotland—roughly speaking, furthest from the centre of high mean pressure for the month), but the well-known irregularity of distribution of thunderstorm-rains makes it difficult to convey a clear idea of the fall.

Of the 50 stations in the table above referred to, thirteen had less than one-quarter of the average rainfall :—

STATION.	COUNTY.	Rainfall in.	Rainy days.	Per cent. of average.
Cargen [Dumfries]	Kirkcudbright	·22	3	6
Waringstown	Down	·29	5	9
Jedburgh, Sunnyside	Roxburgh	·29	6	11
Maidstone, Hunton Court	Kent	·35	2	14
Newcastle, Town Moor	Northumberland.	·44	5	16
Leicester, Barkby	Leicester	·44	6	17
Boston	Lincoln	·48	3	17
Polapit Tamar [Launceston]	Devon	·66	10	18
Ballinasloe	Galway	·57	7	20
Weymouth, Langton Herring	Dorset	·54	4	22
Bury St. Edmunds, Westley	Suffolk	·58	3	22
Omagh, Edenfel	Tyrone	·76	7	22
Haverfordwest	Pembroke	·98	10	22

Seventeen more stations had less than half the average :—

Station.	County.	Rainfall in.	Rainy days.	Per cent. of average.
Winslow, Addington	Bucks	·69	5	26
Dublin, Fitzwilliam Square	Dublin	·54	7	27
Tenbury, Orleton	Worcester	·70	7	27
Dundee, Eastern Necropolis	Forfar	·80	10	32
Stroud, Upfield	Gloucester	·98	10	34
Cardiff, Ely	Glamorgan	1·29	9	35
Hesley Hall [Tickhill]	Nottingham	·78	6	36
Hitchin	Hertford	·92	5	37
Wetherby, Ribston Hall	York	·97	5	39
Loch Leven Sluices	Kinross	1·10	6	39
Carlow, Browne's Hill	Carlow	1·10	8	39
Aberystwith, Gogerddan	Cardigan	1·70	7	40
Londonderry, Creggan Res.	Londonderry	1·53	11	41
Manchester, Plymouth Grove	Lancashire	1·44	6	42
Church Stretton, Woolstaston	Shropshire	1·08	10	43
Hull, Pearson Park	York	1·08	7	44
Borrowdale, Seathwaite	Cumberland	5·35	14	46

As out of the 50 stations there are only 41 for which the average is available, it may be taken as a rough generalization that over one-third of the kingdom the rainfall of the month was less than one-quarter of the average, and over three-quarters of the kingdom was less than half.

DROUGHT.

That there was no remarkable intensity of drought is shown by the following table, the stations in which were selected for their fairly representative geographical distribution, without reference to their total rainfall :—

Droughts in September, 1895.

Absolute Droughts.—Periods of more than 14 consecutive days absolutely without rain.
Partial Droughts.—Periods of more than 28 consecutive days, the aggregate rainfall of which does not exceed 0·01 in. per diem.

Station and County.	Absolute Droughts.			Partial Droughts.			
	Began.	Ended.	Lasted.	Began.	Ended.	Lasted.	Amount
			Days.			Days.	in.
London, Camden Square, *Middlesex.*	Sept. 11	Sept. 30	20	None.	...	...	..
Denver, ... *Norfolk.*	Sept. 7	Sept. 30	24	None.	...	...	...
Torquay, Cary Green, ... *Devon.*	Aug. 27	Sept. 10	15	Aug. 14	Sept. 29	47	·27
	Sept. 12	Sept. 29	18				
Bamburgh, ... *Northumberland.*	None.	...	...	Aug. 27	Sept. 30	35	·35

At the following stations, neither an absolute nor a partial drought occurred: Ross, The Graig, *Hereford*; Leicester, Barkby, *Leicester*; Preston, Haighton, *Lancashire*; Hull, Pearson Park, *York, E.R.*; Haverfordwest, *Pembroke*; Llandundno, *Carnarvon*; Edinburgh, Blacket Place, *Edinburgh*; Keith, H.R.S., *Banff*; Caher, Duneske, *Tipperary*; Omagh, Edenfel, *Tyrone*.

It will thus be seen that at 10 out of the 14 stations neither partial nor absolute drought occurred, and that the four absolute and two partial droughts recorded are not of remarkable duration.

TEMPERATURE.

As regards temperature, the records for September, 1895, appear to be much more remarkable, but we have not readily available for comparison the results of back years at a large number of stations.

The first table gives the daily maxima at 29 stations from the 23rd to the 29th, and includes all days in the latter half of September, on which we have records of 80° or upwards from British stations. There was another period of high temp. about the 9th, but although some stations recorded the absolute max. for the month on that date, the heat was neither so prolonged nor so remarkable as in the latter half of the month :—

Maximum Temperatures, September 23rd to 29th, 1895.

STATIONS	23rd.	24th.	25th.	26th.	27th.	28th.	29th.
	°	°	°	°	°	°	°
Kensington (Edith Road)	68·7	85·8	81·9	83·9	82·7	80·4	77·3
London (Old Street), E.C.	77·0	74·7	76·2	72·2	81·6	80·1	76·8
,, (Regent's Park, Roy. Botanic Soc.)	70·2	82·8	79·0	80·0	80·0	77·8	75·0
,, (Camden Square) (*Stevenson Screen*)	73·7	83·2	81·0	82·4	82·3	79·2	77·1
,, (,, ,,) (*Glaisher ,,*)	73·3	82·8	80·6	82·4	82·6	79·2	77·1
West Norwood (Thornlaw Road)	81·2	85·5	81·4	81·8	80·7	77·7	74·9
Brixton (Acre Lane)	79·0	86·0	83·0	85·0	84·0	81·0	78·0
Greenwich (Royal Observatory)	80·8	87·3	84·0	84·2	83·2	80·5	77·6
Dungeness	70·0	74·0	72·0	71·0	71·0	69·0	68·0
Great Berkhampstead (Rosebank)	77·9	82·2	79·4	81·7	82·1	79·6	76·2
Winslow (Addington Manor)	79·2	84·2	79·2	80·2	81·0	77·7	72·2
Oxford (Radcliff Observatory)	78·0	82·0	79·0	82·0	83·0	81·0	76·0
Cambridge Observatory	78·0	84·0	83·0	82·0	82·0	80·0	77·0
Chelmsford	74·3	78·4	80·9	79·4	77·1	75·6	73·9
Norwich, (Brundall)	77·2	75·8	79·0	80·0	75·0	77·0	72·6
Weymouth, (Langton Herring)	70·0	71·0	67·0	75·0	72·0	73·0	73·0
Cheltenham (Southam Villa)	78·0	82·2	77·6	81·3	83·0	81·4	78·0
Ketton Hall [Stamford]	80·0	85·0	84·0	82·0	84·0	82·0	79·0
Bolton, (The Park)	73·3	78·0	75·2	76·3	79·2	81·1	76·6
York (Philosophical Society)	74·0	81·0	80·0	82·0	81·0	82·0	82·0
Pembroke (St. Ann's Head)	69·0	66·0	64·0	71·0	72·0	74·0	72·0
Llandudno	73·0	71·6	73·6	76·4	77·5	82·4	81·4
Edinburgh (Blacket Place)	69·8	68·0	78·3	73·3	73·1	68·7	59·1
Nairn (School House)	69·0	65·0	77·0	68·0	75·0	63·0	67·0
Parsonstown	74·0	72·0	70·0	76·0	77·0	75·0	77·0
Seaforde	64·0	67·0	66·0	68·0	67·0	69·0	67·0
Jersey	77·0	82·0	72·0	81·0	85·0	84·0	76·0
Paris	87·0	89·0	88·0	88·0	89·0	86·0	84·0
Berlin	70·0	73·0	64·0	68·0	72·0	72·0	73·0
Brussels	81·0	84·0	85·6	86·0	82·0	77·0	77·0

It will be noticed that there is an excess of records for the neighbourhood of London, the reason for which will be mentioned later.

A second table gives the absolute maxima at additional stations provided with Stevenson screens :—

September 23rd to 29th.

STATIONS.	Max. temp	Date	STATIONS.	Max. temp	Date.
	°			°	
Wallington	84·7	24	Cheadle(The HeathHouse)	78·5	24
Birchington (Thor)	81·0	25	Worcester (Diglis Lock)..	83·0	27, 29
Oxford (Mag. Coll. Laboratory)	80·0	27	Workop (Hodsock Priory)	82·2	24
Ashburton (Druid House)	76·7	27	Belper (Northfield).....	79·6	24
Tavistock (Rose Villa)	82·7	27	Driffield (York Road).....	78·0	26
Ross (The Graig)	81·2	27	Killarney (Woodlawn) ...	76·0	28

At Camden Square the results for September are—

	Absolute Max.	Average Max.	Average Min.	Mean of Max. & Min.
1895	82°·8	73°·7	51°·5	62°·6
Average 36 years ...	77°·0	67°·2	49°·6	58°·4
Excess of 1895 ...	5°·8	6°·5	1°·9	4°·2

In the 36 years the average max. has been exceeded only by 76°·4, in 1865, and the mean of the max. and min. by 65°·5, in the same year. The average min. has been exceeded six times, but this would naturally be expected, as comparatively clear skies and considerable radiation at night are component parts of a fine warm month.

The absolute max. has been exceeded in six years, but in considering this element, due allowance must be made for the lateness of the date on which the reading occurs. This will be most clearly shown by setting out all readings above that of September 24th, 1895.

		°				°	
1858	...	85·0	on 12th.	1868	...	84·0	on 4th.
1865	...	84·0	,, 7th.	,,	...	86·5	,, 6th.
,,	...	85·0	,, 8th.	,,	...	91·0	,, 7th.
,,	...	84·8	,, 15th.	1872	...	83·1	,, 3rd.
,,	...	85·0	,, 16th.	1880	...	83·3	,, 3rd.
				,,	...	88·3	,, 4th.
				1886	...	84·2	,, 1st.

The latest of these dates is the 16th, or eight days earlier than the max. in September, 1895.

In September, 1865, the temp. rose above 80° on ten days, and in September, 1868, on five days, in no other year was 80° recorded on as many days as in 1895. So that although the max. of September, 1895, is unprecedented at so late a date, the month, as a whole, must clearly yield precedence to 1865.

The Greenwich values for the month, given by the Astronomer Royal in a letter to the *Times*, are :—

	Absolute Max.	Average Max.	Average Min.	Mean temp.
1895	87°·3	75°·4	51°·3	62°·2
Average 50 years ...	—	67°·3	49°·1	57°·2
Excess of 1895 ...	—	8°·1	2°·2	5°·0

For the nine days, September 23rd to October 1st, the mean max. was 17°·2 above the average, and the mean temp., 11°·3 above the

average. In September, 1895, there were ten days on which the temp. rose above 80°, a greater number than in any previous September from 1841.

The maxima for each of the eight days (September 23rd to 30th), and the mean temperatures for each of the seven days (September 24th to 30th) exceed those for the corresponding days in any year from 1841.

Reference has already been made to the disproportionate number of London stations quoted in the table of maxima from September 23rd to 29th, the object being to show the great variation in the temperatures recorded in different parts of the metropolis. It will be seen that the difference of pattern of stand cannot account for it, as at Camden Square the mean in the Stevenson screen for the seven days is in excess of that on the Glaisher by only 0°·1, and it will further be seen that the maxima at Greenwich (where also a Glaisher pattern stand is used) were generally above those at other stations, thus by no means supporting the suggested heating up of the interior of a Stevenson screen.

On 23rd	the values	range	from	81°·2	at	West Norwood	to 68°·7 at Kensington.
,, 24th	,,	,,		87·3	,,	Greenwich	,, 74·7 ,, Old Street.
,, 25th	,,	,,		84·0	,,	,,	,, 76·2 ,, ,,
,, 26th	,,	,,		85·0	,,	Brixton	,, 72·2 ,, ,,
,, 27th	,,	,,		84·0	,,	,,	,, 80·0 ,, Regents Park.
,, 28th	,,	,,		81·0	,,	,,	,, 77·7 ,, WestNorwood.
,, 29th	,,	,,		78·0	,,	,,	,, 74·9 ,, ,, ,,

The range on the 23rd and 24th is very striking, and the Old Street values suggest that London smoke resisted the penetration of the heat for several days. The following letter from the Observer at Kensington throws considerable light on the matter:—

SIR,—I do not know whether a few lines showing the curious differences of temperature produced by fog at stations near together may be of interest to your readers. Yesterday (September 23rd) the max. at the London Station (Brixton) was 79°. My max. was 68°·7. A thin white fog prevailed all day, though the sun shone through it pretty strongly. A difference of 10° or more is not uncommon in winter fogs, but I have never seen anything like this in summer.—Yours faithfully,

G. VON U. SEARLE.

Edith Road, West Kensington.

FOREIGN.

In his monthly *résumé* for September, 1895, M. E. Renou, of the Observatory of Parc St. Maur, Paris, says:—"The true daily mean temperature (65°·6) appears to be the highest that has been observed for a century and a half, but it is difficult to make absolute comparisons with the old observations, because of the different positions of the instruments. For September, 1865, the mean of the daily max. and min. gives 66°·9; at the Parc St. Maur the same calculation for this year gives 67°·1."

"It is unprecedented to record 11 days of maxima above 86°, but this number of days has been the same at Vendôme, in a very good position. Although during a century and a half no higher maximum than 89°·4 had been recorded, the maximum on September 7th, 1895, reached 95°·9."

"The insignificant rainfall (·004 in.) is also unprecedented."

Speaking of Brussels, M. Lancaster, in *Ciel et Terre*, says:—"During 60 years before 1895 September has only once been warmer than the summer months, viz., in 1841. September, 1895, was probably the most beautiful, the warmest, and the driest for two centuries. The mean temperature (64°·2) exceeded the average for September by 5°·9 and the average for July by 0°·5, and the highest mean previously recorded (63°·0 in 1865) by 1°·2. On 15 days the maximum attained 77°, compared with an average of 1·3 days and a previous maximum of 7 days."

OBSERVERS' NOTES.

In conclusion, we quote a few extracts from letters received from our correspondents:—

Tenterden, Kent.—We have had no September to compare with this since 1865. Mean max. temp., 73°; mean min., 51°; 6 days over 80°; max., 84°·5 in Stevenson screen. Two hotter days occurred in September, 1886, but earlier in the month. Temp. above 70° on 9 days, against 8 in 1884 and 1886.—J. ELLIS MACE.

Hitchin, Herts.—Tuesday, the 24th, was the hottest day at present this year, 82°·5. The mean temperature of the month was 60°·4, the average for September being 54°·8. Since 1849 we have once had a higher mean in September, that was in 1865, when it was 60°·5, but the maximum in that month never reached 80°. With the exception of 1891, when we had 80°, 81° and 80° consecutively, I have no previous record of 80° or upwards in Sept.—W. LUCAS.

Hillington Rectory, Norfolk.—The highest temperature recorded was 83°·3 on the 25th; 80°·3 was registered on the 24th, and 80°·1 on the 26th. (The highest during the month was 84°·5 on the 2nd) It is very rare here for readings to exceed 80° in September. The only instances since 1863 are:—

1868	.....	80 on 6th, and 83 on 7th.
1871	.....	80 on 1st.
1880	.....	84 on 3rd, and 85 on 4th.
1884	.....	84 on 17th.
1891	.....	82 on 10th, and 81 on 11th.

In September, 1888, the temperature did not rise to 68°. The mean of maxima during the week 22nd to 28th was 78°·3; of mimima 49°; mean of all readings 62°·9, 10° above average. Sunshine was very abundant. There was no rainfall, but 0·02 in. was yielded by dew, which was very heavy.—H. FFOLKES.

Heath Lodge, Cheltenham, Gloucester.—In the early part of September, 1868, we had six days above 80°; on the 7th the maximum was 88°. In 1880 the 2nd, 3rd and 4th of September were above 80°, that on the 4th being 89°. The occurrence of a hot period so late in the month as in 1895 is unusual.

Sept. 23	.....	82·2	Sept. 27	.....	87·0
,, 24	.....	86·0	,, 28	.....	85·7
,, 25	.....	80·5	,, 29	.....	82·0
,, 26	.....	85·0			

The highest minimum was 62°·0 on the 25th.—M. A. SMELT.

The Graig, Ross, Hereford.—The temperature rose above 70° on 19 days, and above 80° on 4 days. The average max. was 72°·2; the only other September with an average max. above 70° since 1859 being 1865, when it was 73°·3. The only falls of rain of consequence were on the 6th and 24th, and the drought was beginning to be felt at the close.—H. SOUTHALL.

Hodsock Priory, Notts.—The mean temp., 59°·4, is 3°·9 above the average, and the highest in September in 19 years. Though the absolute max. (82°·2 on 24th) has once been exceeded, temperatures of 80° have never before been recorded in the second half of the month.—H. MELLISH.

Blacket Place, Edinburgh.—The maximum shade temperature recorded to-day (September 25th), namely, 78°·3, is absolutely the highest registered so late in the season during 55 years. In the following table will be found a list of all the September days on which the temperature exceeded 75° in the shade :—

Year.	Date.	Temp.	Year.	Date.	Temp.
1841	12	77·0	1868	6	81·7
,,	13	76·0	,,	7	77·0
1844	1	77·0	1873	27	76·2
1846	11	78·0	1890	8	76·0
,,	12	78·0	,,	7	75·1
,,	14	76·6	1891	10	77·0
1848	23	76·0	,,	12	79·8
1857	5	78·0	1895	25	78·3
,,	6	77·9			

It will be seen that only two higher maxima are on record, viz. September 6th, 1868, 81°·7, and September 12th, 1891, 79°·8 The average temperature of to-day (66°·7) is a phenomenally high mean for the time of year. Forbes, in his "Climate of Edinburgh," gives 64°·5 as the highest mean for any day in the second half of September, the period dealt with being the forty years 1795–1805, 1821–1850. I have examined the Edinburgh observations taken subsequent to 1850, as well as a number of other older registers, but no instance of such extreme heat as we have experienced to-day has been registered so far on in September. September 28th, 1802,

was possibly warmer, the thermometer at noon standing at 75° in the shade, but there was no registering instrument in use at that time.—R. C. MOSSMAN.

OCTOBER, 1895.

It is remarkable that a September with a period of heat in some respects unprecedented, should be followed by an October including a period as unprecedentedly cold.

At Camden Square the min. in shade for October, 1895, is 26°·6 on the 28th. Frost occurred in shade on seven days in the month, and those seven days were consecutive, from 24th to 31st. Looking back through the 38 years over which the observations extend we find that the absolute minimum has been lower in only three Octobers :—

26°·2	on October	5th, 1873.
25°·4	,,	26th, 1887.
23°·8	,,	28th, 1890.

That in only one other October has frost in shade been recorded on seven days (in 1887), and that the greatest number of consecutive days with temp. falling to freezing point in previous Octobers, is four, in 1859, and in 1873.

A comparison of the seven days, 24th to 30th of September, with the corresponding seven days of October, is very striking :—

	Mean. 9 a.m.	9 p.m.	Max.	Min.	Mean. temp.
	°	°	°	°	°
1895, September 24th to 30th...	63·5	61·9	80·3	54·9	65·0
1895, October 24th to 30th ...	32·9	36·6	44·8	28·2	35·9
Fall of temp. in one month ...	30·6	25·3	35·5	26·7	29·1

BELGIAN RAINFALL.

We are very glad to find that M. Lancaster did not, by the expression "strictly comparable," intend to imply that the rainfall at Uccle could be treated as a continuation of the Brussels register, but that the gauges and the conditions of exposure are similar at the new observatory to what they were at the old one. As the sentence stood, on p. 143, we did not see any indication that M. Lancaster realized the fact that the difference between the mean fall in the old locality, and in the new one (which he now puts at 30 mm. [1·18 in.]) must be allowed for, before any determination as to secular change can be arrived at. Now that he has cleared up this point, we have nothing more to say, except that we shall be glad to welcome Part II. of his great work.

THE BRITISH ASSOCIATION AT IPSWICH.

(*Concluded from p.* 141).

MILLER CHRISTY, F.L.S.—*About Rockall.*

The author said that very few persons seemed to know of the existence of Rockall, although it is a British possession. It is a lonely rock of pyramidal shape, 184 miles west-half-south from St. Kilda, in the Outer Hebrides, and 290 miles from the nearest point of the Scottish mainland. The rock, which at its base has a circumference of about 250 feet, is composed of coarse dark-coloured granite, and is said to be highly magnetic. Its summit is always whitened by the dung of sea-birds, and persons sighting the Rock from a distance almost invariably take it for a vessel in full sail. Owing to the prevalence of the Atlantic swell, it is only possible to land upon the Rock in the finest weather. To the man of science, Rockall presents many points of considerable interest. It is highly desirable that some effort should be made to examine the rock, and to investigate its organic inhabitants in a thoroughly scientific manner. Even if there is no naturalist both willing and able to make the journey to Rockall, surely there are plenty of yachtsmen who would be glad to have a definite and useful object for a cruise. To such he suggested a trip to Rockall, and he would be glad to give all the information required concerning the matters to which special attention should be given by any intelligent person visiting the Rock.

The Chairman said that for purposes of meteorological observation residence on the island would be necessary. Seeing that at some seasons of the year landing is very difficult, any person landing should be prepared for a long stay.

Mr. G. J. Symons said that some years ago application was made to the Royal Meteorological Society for financial assistance in establishing a station on the island; but the Society came to the conclusion that nothing could be done without considerable expenditure, inasmuch as buildings as strong as a lighthouse and a cable connecting with the mainland would be necessary.

Dr. H. R. Mill asked whether it would not be advisable to have preliminary observations made by self-recording instruments before approaching the Government to establish a meteorological station.

Mr. Dickson stated that Rockall lay in the track of the greater number of cyclones approaching the British Islands, and that telegraphic information from it would be of great importance for weather warnings.

The Chairman closed the discussion by advising Mr. Christy to keep "pegging away" at the subject, and, if possible, bring it to the attention of someone who might be inclined to follow the example of the Prince of Monaco.

DR. THISELTON DYER.—*Exhibition of Photographs and Specimens of a Cedar Struck by Lightning.*

This was a very fine Deodar completely ruined by a single stroke. The wood was not splintered so much as oaks usually are.

PROF. SCHUSTER, F.R.S.—*Some Observations with Lord Kelvin's Portable Electrometer.*

During a recent visit to the Engadine, Prof. Schuster has made observations on the atmospheric electricity near the ground at different heights above sea-level. The readings were taken with Lord Kelvin's portable electrometer, which worked very satisfactorily and seems well adapted for such purposes. In all cases positive charges were found, increasing with height, but in an apparently erratic fashion. The normal positive charge at the foot of a glacier was found to be strengthened by a wind blowing down it, and Lenard's observa-

tions on the negative electricity of waterfalls were all confirmed. The daily curve of atmospheric potential in the valley of Pontresina shows a maximum at 11 a.m., dipping a little and rising again to an afternoon maximum at 5 p.m., then rapidly descending as the evening breeze sets in. Discussion on the paper related chiefly to the behaviour and temperature errors of portable electrometers, the latter being somewhat large and quite unexplained. Prof. Ayrton suggested a crucial experiment to determine whether atmospheric electricity is due to an actual distribution in the air, or to induction from the earth's surface.

PROF. MICHIE SMITH.—*Indian Thunderstorms.*

This paper gave the results of observations made at Madras. There, he said, sheet lightning occurs every evening for several months, always near the horizon and directed towards the south-west. The time of occurrence varies from day to day, but is always evening, and generally not later than 9 p.m. It is not a reflection of distant lightning flashes, but consists of an actual discharge of electricity from cloud to cloud, or between two portions of the same cloud, and it takes place in the upper portions of low-lying clouds. When morning lightning occurs its direction is north-east. Hence the lightning is always to be looked for in the regions of still air, where the land and sea breezes meet. The time of occurrence depends on the hour when the sea breeze sets in, the display being about three hours later than this. Cumulus clouds rise together in pairs, and the discharge takes place between them, sometimes possibly within them. He thought that the electrical conditions of the clouds might be accounted for by the fact that the sea breeze is moist and dustless, while the land breeze is dry and dusty. It is known that the air is negatively electrified relatively to the ground when the air and earth are both dusty, while the sea breeze brings a strong positive electrification. The equalization of the electric conditions of these clouds will result in sheet lightning. The presence of dust in the clouds is shown when they sink rapidly; the dust is then seen at their edges, and gives the iridescent or nacreous appearance frequently observed.

Mr. John Aitken said that his observations on the Rigi confirmed Professor Michie Smith's theory. He believed that thunderstorms resulted from an influx of pure air into dusty regions; the thunderstorm was the effect of purifying the air, not the cause of it. In support of this view he gave an instance of thunderstorms occurring for several days in succession without any apparent purification of the air; eventually the air was purified and the thunderstorms ceased.

Professor Schuster said he had counted 25 new theories of thunderstorms, all put forward during the past 12 years; in some years as many as four or five theories had been proposed. In connection with the electrification of air he thought Lenard's observation of the electricity of waterfalls was important; Lenard found that the air coming from a spray of a fall of pure water was charged negatively, that from salt water, on the other hand, is positively electrified. This accounts for the positive charge of the sea breeze. He thought the dust in air was generally gathered up locally, excepting that at high levels, as in the case of the Krakatoa erupton. He supposed Professor Michie Smith would not deny the possibility of nacreous clouds being due to a current of air rising through the stationary cumulus cloud. He had often observed nacreous clouds in England, when the light was favourable; but he had connected them with cirrus rather than cumulus clouds, and attributed their iridescence to ice particles instead of dust.

Professor Michie Smith, in reply, said that the iridescence of nacreous

clouds occurred so near the edge of the cumulus and fitted it so closely, that he regarded the phenomenon as produced by it.

G. J. SYMONS.—*Notes on Autumn Floods of* 1894.

The facts quoted in this paper having all been given either in the paper read before the Royal Meteorological Society by Messrs. Symons and Chatterton, or in *British Rainfall*, 1894, it is unnecessary to set them out, but the author concluded by pleading strongly for some organised system of preserving records of floods, by collecting the inscriptions on such iron plates as are at present to be found on some rivers, marking the flood levels by insuring a more methodical record in future, and other similar means.

The President of the Section (Mr. Vernon Harcourt) supported Mr. Symons's suggestions respecting flood marks and records, and urged that further steps should be taken to prevent floods on rivers, and that communication should be systematically established between the different points on a river, in order that the sluices might be opened in time to avert flooding.

Mr. Symons, in replying, mentioned that in France there was along the rivers an almost perfect system of taking and recording levels, and of telegraphing down when floods were approaching.

W. H. WHEELER.—*The Effect of Wind and Atmospheric Pressure on the Tides.*

The author has been making observations on this subject for many years. From an analysis of two years' tides at the Port of Boston (Lincoln), excluding occasions when the element of wind would affect the case, he found that out of 152 observations, 61 gave results opposite to that which would have been expected by the readings of the barometer alone; for a high barometer was frequently accompanied by a high tide, and a low barometer by a low tide. On the other hand it was found, with few exceptions, that when the wind blows with any force along a coast in the same direction as the main stream of the flood tide, the tides at all the ports along the coast will be higher than the calculated height given in the tide-tables; and when the wind blows against the flood tide, high-water will be lower than calculated. According to figures quoted in the paper, the effect of wind is such as to affect the tide as much as 5 to 6 feet, and a difference of as much as 8 feet has been observed between two succeeding tides. An analysis of the register of tides at Boston Dock for two years showed that 24 per cent. of those recorded were sufficiently affected by the wind to vary 6 inches from the calculated height. Thirty varied by 2 feet, seven by 3 feet, six by 3½ feet, three by 4 feet, two by 4½ feet, one by over 5 feet, and one by 6 feet 3 inches. From the observations Mr. Wheeler has deduced the approximate rule that with a given force of wind of 3 on the Beaufort scale a tide will be raised or depressed by half an inch for every foot of range. With a force of from 4 to 6, the variation may be expected to be 1 inch for every foot, with a gale force of 7 to 8 it will be 1½ inches, and if the gale increases to 10 it will be 2 inches. It will be seen that the subject is one which possesses not only scientific interest, but considerable practical importance to mariners; and as far as we are aware, Mr. Wheeler is the first who has obtained quantitative results of this nature. In the discussion which followed, it was pointed out that the time element would have to be given its due value.

W. H. WOOD.—*On the Zodiacal Light considered as an Atmospheric Phenomenon.*

W. H. WOOD.—*On the Local Origin of the Aurora Borealis.*

We are unable to obtain abstracts of these two papers.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	67·1	29	29·1	1	57·9	40·8	41·2	77	113·6	25·4	1·34	13	6·4
Malta	80·4	27	51·3	2	70·3	56·5	54·0	77	133·5	45·6	·12	2	4·9
Mauritius	83·4	3	63·8	27	81·1	71·4	68·5	79	133·0	54·8	2·62	12	5·6
Calcutta	99·4	28	66·6	8	92·2	73·9	72·2	71	158·2	60·4	1·76	4	3·7
Bombay	93·0	19	74·1	6	88·5	77·1	73·4	74	140·8	64·8	·00	0	0·9
Ceylon, Colombo	93·2	29	73·0	...	90·9	75·6	73·8	80	146·5	68·0	9·34	24	6·3
Melbourne	84·9	19	39·9	13	70·0	51·3	48·9	71	135·1	31·1	1·55	11	2·3
Adelaide	86·9	2	45·4	11	71·7	55·6	51·1	64	143·2	38·8	4·18	16	5·9
Sydney	79·0	20	50·8	24	70·9	58·1	58·0	80	134·0	43·6	2·32	13	4·6
Wellington	66·0	7	41·0	4*b*	59·2	47·9	45·1	73	121·0	28·0	11·23	19	5·2
Auckland	71·0	21	43·0	10	65·4	52·5	46·6	66	128·0	40·0	1·78	14	5·0
Jamaica, Kingston	90·3	20	67·8	14	86·5	71·1	69·7	78	...	...	·98	8	4·4
Trinidad	92·0	27*a*	64·0	1	89·5	69·1	68·8	68	174·0	63·0	2·52	8	...
Grenada	85·6	27	72·0	12*c*	82·6	74·1	67·6	67	148·6	...	4·05	15	2·7
Toronto	69·1	19	23·7	...	51·2	35·5	32·9	66	...	16·2	1·52	12	5·6
New Brunswick, Fredericton	66·7	21	11·2	12	51·1	28·7	27·8	60	...	...	3·15	10	4·6
Manitoba, Winnipeg	70·7	17	19·2	25	62·1	32·6	...	...	...	...	·62	8	6·3
British Columbia, Esquimalt	63·4	21	30·2	5	54·4	39·0	42·3	88	...	...	2·02	16	6·8

a—and 28; *b*—18 and 30; *c*—and 30.

REMARKS.

MALTA.—Adopted mean temp. (62°·0), 2°·2 above the average. Mean hourly velocity of wind 10·6 miles. Temp. of sea rose to 65°·4. Lightning was seen on the 20th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·5 below, of dew point 0°·2 above, and rainfall 3·18 in. below, their respective averages. Mean hourly velocity of wind 8·2 miles, or 2·3 below average; extremes, 19·9 on 1st, and 1·7 on 8th and 10th; prevailing direction, E.S.E. Thunder and lightning on 4th. Lightning on 16th and 17th, and thunder on 20th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 18 days. D. G. MANTELL.

Adelaide.—Mean temp. 0°·5 below the average of 38 years. Rainfall 2·51 in. above the average. C. TODD, F.R.S.

Sydney.—Mean temp. same as the average; humidity 2 above, and rainfall 3·53 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Showery in the early part; but on the 12th heavy rain commenced, with a gale from S.E., and continued without ceasing until the night of 15th, the total fall being 9·90 in. A few fine days followed, but the last part of the month was showery. Altogether most unpleasant and stormy. Mean temp. 3°·4 below, and rainfall 7·71 in. above, the average. R. B. GORE.

AUCKLAND.—An unusually dry and cool month, the rainfall being barely more than half the average, and the mean temp. 3° below the average. A strong N.E. gale from the 13th to the 15th, and S.E. gale on 27th and 28th. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·3 miles. Rainfall a little below the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·49 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall .	3·61	XI.	Lake Vyrnwy	5·17
,,	Birchington, Thor	2 8 2	,,	Corwen, Rhug	3·42
,,	Hailsham	3·87	,,	Carnarvon, Cocksidia ...	6·34
,,	Ryde, Thornbrough	4·02	,,	I. of Man, Douglas	5·79
,,	Emsworth, Redlands ...	3·46	XII.	Stoneykirk, Ardwell Ho.	4·86
,,	Alton, Ashdell	3·50	,,	New Galloway, Glenlee	4·32
III.	Oxford, Magdalen Col..	2·78	,,	Melrose, Abbey Gate...	...
,,	Banbury, Bloxham	3·32	XIII.	N. Esk Res. [Penicuick]	3·85
,,	Northampton, Sedgebrook	2·50	,,	Edinburgh, Blacket Pl..	3·30
,,	Alconbury	2·19	XIV.	Glasgow, Queen's Park..	2·95
,,	Wisbech, Bank House...	2·66	XV.	Inverary, Newtown	3·40
IV.	Southend	2·88	,,	Islay, Gruinart Schools..	3·43
,,	Harlow, Sheering..... ...	2·20	XVI.	Dollar.....	3 03
,,	Colchester, Lexden	1·80	,,	Balquhidder, Stronvar...	2·94
,,	Rendlesham Hall	2·66	,,	Ballinluig	2·02
,,	Diss	2·52	,,	Dalnaspidal H.R.S.....	4·53
,,	Swaffham	2·11	XVII.	Keith H.R.S.....	7·90
V.	Salisbury, Alderbury ...	3·36	,,	Forres H.R.S.	4·60
,,	Bishop's Cannings	3·97	XVIII.	Fearn, Lower Pitkerrie..	3·24
,,	Blandford, Whatcombe .	4·33	,,	Loch Shiel, Glenaladale	...
,,	Ashburton, Holne Vic...	5·23	,,	N. Uist, Loch Maddy ...	4·77
,,	Okehampton, Oaklands.	7·60	,,	Invergarry.....	4·79
,,	Hartland Abbey	6·78	,,	Aviemore H.R.S.	3·80
,,	Lynmouth, Glenthorne.	8·48	,,	Loch Ness, Drumnadrochit	3·93
,,	Probus, Lamellyn	7·99	XIX.	Invershin	3·03
,,	Wellington, Sunnyside..	...	,,	Scourie	10·03
,,	Wincanton, Stowell Rec.	3·36	,,	Watten H.R.S.....	3·68
VI.	Clifton, Pembroke Road	4·25	XX.	Dunmanway, Coolkelure	5·81
,,	Ross, The Graig	2·68	,,	Fermoy Gas Works	2·10
,,	Wem, Clive Vicarage ...	2·86	,,	Killarney, Woodlawn ...	4·00
,,	Cheadle, The Heath Ho.	2·39	,,	Caher, Duneske	3·13
,,	Worcester, Diglis Lock	2·24	,,	Ballingarry, Hazelfort...	3·20
,,	Coventry, Coundon	3·75	,,	Limerick, Kilcornan ...	4·68
VII.	Ketton Hall [Stamford]	1·75	,,	Ennis	3·07
,,	Grantham, Stainby	3·74	,,	Miltown Malbay	3·86
,,	Horncastle, Bucknall ...	2·09	XXI.	Gorey, Courtown House	2·60
,,	Worksop, Hodsck Priory	2·62	,,	Athlone, Twyford	3·19
VIII.	Neston, Hinderton	4·75	,,	Mullingar, Belvedere ...	3·14
,,	Preston, Haighton	...	,,	Longford, Currygrane...	2·86
,,	Broughton-in-Furness ...	7·27	XXII.	Woodlawn	3·62
IX.	Ripon, Mickley.....	3·34	,,	Crossmolina, Enniscoe ..	6·79
,,	Melmerly, Baldersby ...	2 95	,,	Collooney, Markree Obs.	5·14
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton ...	3·62	XXIII.	Lough Sheelin, Arley...	2·56
X.	Haltwhistle, Unthank...	3·96	,,	Warrenpoint.....	3·02
,,	Bamburgh	4·69	,,	Seaforde..	3·29
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	4·94
XI.	Llanfrechfa Grange	3·70	,,	Bushmills, Dundarave..	6·90
,,	Llandovery	5·03	,,	Stewartstown	3·78
,,	Castle Malgwyn	4·47	,,	Buncrana	7·81
,,	Builth, Abergwessin Vic.	6·81	,,	Lough Swilly, Carrablagh.	7·82
,,	Rhayader, Nantgwillt...	6·49			

OCTOBER, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATU Max. Deg.	Date	Mi Deg.
			inches.	inches.	in.					
I.	ENGLAND.	London (Camden Square) ...	2·84	— ·05	1·14	5	14	74·4	1	26·6
II.		Maidstone (Hunton Court)...	3·07	— ·39	·80	8	11	...	...	...
,,		Strathfield Turgiss	3·69	+ ·85	1·13	5	16	71·1	1	21·2
III.		Hitchin	2·49	— ·58	·73	8	14	72·0	1	24·0
,,		Winslow (Addington)	2·65	+ ·44	·85	8	15	74·0	1	19·0
IV.		Bury St. Edmunds (Westley)	2·34	— ·93	·34	5, 10	14	70·0	1	21·0
,,		Norwich (Brundall)	4·00	...	·63	8, 29	23	75·0	1	25·0
V.		Weymouth(LangtonHerring)	3·27	— ·27	·89	7	16	68·0	1	29·0
,,		Torquay (Cary Green)	3·91	...	·77	8	16	67·4	1	30·0
,,		Polapit Tamar [Launceston]..	6·45	+ 1·62	1·02	30	21	69·1	1	22·6
VI.		Stroud (Upfield)	3·24	+ ·21	·85	5	19	68·0	1	25·0
,,		ChurchStretton(Woolstaston)	2·49	— 1·28	·67	21	16	64·5	1	22·0
,,		Tenbury (Orleton)	2·41	— ·80	·65	21	15	67·5	1	21·5
VII.		Leicester (Barkby)	3·05	— ·10	·84	8	19	75·0	1	18·0
,,		Boston	2·73	— ·38	1·02	8	15	75·0	1	25·0
,,		Hesley Hall [Tickhill].....	2·55	— ·55	·85	8	15	71·0	1	24·0
VIII.		Manchester(PlymouthGrove)	3·46	+ ·09	·68	2	19	71·0	1	25·0
IX.		Wetherby (Ribston Hall) ..	3·74	+ ·61	·98	10	13	...	...	...
,,		Skipton (Arncliffe)	5·94	— ·09	1·26	3	20	..	...	...
,,		Hull (Pearson Park).	3·24	— ·41	·80	8	17	71·0	1	23·0
X.		Newcastle (Town Moor)	4·00	+ ·88	1·09	15	18	...	...	...
,,		Borrowdale (Seathwaite).....	10·78	+ ·19	1·66	2	18	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·70	+ ·16	1·13	5	17	...	...	...
,,		Haverfordwest	5·34	+ ·19	1·24	1	24	66·3	1	31·0
,,		Aberystwith (Gogerddan) ...	6·96	+ 1·61	1·21	1	19	68·0	1	...
,,		Llandudno.....	6·28	+ 2·89	·85	1	24	68·0	1	32·0
XII.	SCOTLAND.	Cargen [Dumfries]	3·61	+ ·35	·80	1	12	71·2	1	21·2
,,		Jedburgh (Sunnyside).....	5·19	+ 2·54	·73	13*a*	18	73·0	1	23·0
XIV.		Colmonell	4·84	...	1·00	1	18	70·0	1	21·0
XV.		Lochgilphead (Kilmory).....	4·85	+ ·06	·86	11	15	...	...	24·0
,,		Mull (Quinish).....	4·23	— 1·06	·76	11	19	...	...	...
XVI.		Loch Leven Sluices	2·30	— ·66	·60	2	10	...	...	...
,,		Dundee (Eastern Necropolis)	1·50	— ·74	·35	1	13	64·1	12	26·6
XVII.		Braemar	3·41	— ·20	1·30	1	26	67·9	1	25·7
,,		Aberdeen (Cranford)	6·37	...	1·88	1	25	63·0	13	26·0
XVIII		Strathconan [Beauly]	5·15	+ ·50	1·00	3	14	...	...	...
,,		Glencarron Lodge.....	11·20	...	2·72	11	25	73·0	1	25·5
,,		Cawdor [Nairn]	5·01	+ 2·28	1·06	2	22	...	...	...
XIX.		Dunrobin	5·91	+ 2·60	1·14	24	18	60·0	13*b*	30·0
,,		S. Ronaldsay (Roeberry).....	3·87	+ ·14	·69	24	26	57·0	1	30·0
XX.		Darrynane Abbey.....	5·58	...	·71	2	21	...	...	...
,,		Waterford (Brook Lodge) ...	2·41	— 1·41	·60	1	11	67·0	2	25·0
,,		O'Briensbridge (Ross)	4·05	...	·69	3	15	...	...	...
XXI.		Carlow (Browne's Hill)	2·43	— ·86	·71	1	13	...	...	...
,,		Dublin (FitzWilliam Square)	2·84	— ·54	·59	1	16	65·8	1	29·6
XXII.	IRELAND.	Ballinasloe	3·24	+ ·25	·80	14	18	60·0	4	23·0
,,		Clifden (Kylemore)	6·88	...	1·20	1	19	...	...	...
XXIII		Waringstown	3·95	+ 1·24	·78	1	15	71·0	1	24·0
,,		Londonderry (Creggan Res.).	7·64	+ 3·97	·77	1	25	...	...	...
,,		Omagh (Edenfel)	4·54	+ 1·44	·54	1	22	59·0	1	29·0

+*Shows that the fall was above the average ; —that it was below it.*
a—and 14. *b*—and 19. c—and 28. d—and 27.

METEOROLOGICAL NOTES ON OCTOBER, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather was very unsettled, with high temp. until the 10th of the month, when it became colder and finer. On the 26th and 28th the min. on the grass touched the lowest reading recorded at this station for the corresponding date in October since the record commenced in 1861, viz., 20°·1 on 26th and 19°·7 on 28th. Swallow last seen on 1st.

HITCHIN.—The coldest October since 1873.

ADDINGTON.—The min. shade temp. of the month (19°) has only once been equalled, viz., on October 28th, 1890. Although a nice quantity of rain fell, the land at the close was still very hard and dry. There was very little wind, and hardly any fog.

BURY ST. EDMUNDS, WESTLEY.—The month was normal till the 24th, when sharp frost set in, which continued till the end of the month with unusual severity. Distant T on 2nd, and T on 5th.

NORWICH, BRUNDALL.—Remarkable for giving the highest and lowest temperatures ever registered by me in the month of October; 75°·0 on 1st, and 25°·0 on 29th. The previous highest was 74°·6 in 1886, and the previous lowest 28°·2 in 1890. The shade temp. fell below 32° each night from 24th to 29th inclusive, and the grass min. below 20° from 26th to 29th inclusive, the lowest being 17°·0 on 28th. S on 29th. L on 23rd, 25th, 26th, and 28th.

LANGTON HERRING.—The first eight days of the month were wet, followed by a dry period of 12 days. S, sleet, and R fell on the 25th, 26th, and 28th. Very great and sudden variations of temperature occurred throughout the month. The great heat of the last week of September lasted to October 1st, when the max. was 68° and the 9 a.m. temp. 64°. On the 2nd the 9 a.m. temp. was 51°, and on the 17th was 10° lower than on the previous day. Another sudden fall occurred on the 22nd, when the max. (40°) was 12° below that of the 21st. From the 22nd to the 30th inclusive the temp. did not rise above 47°, the average min. of the seven days, 24th to 30th, being only 31°. Mean temp. of the month 47°·3, 2°·7 below the average of 23 years. T and L on 2nd, and T on 25th, 27th, 28th, and 29th.

TORQUAY, CARY GREEN.—R ·43 in. below the average. Mean temp. 49°·6, or 1°·8 below the average. Duration of sunshine 100 hours 50 minutes, or 15 hours below the average; 4 sunless days.

POLAPIT TAMAR.—A marked contrast to the previous month, both as regards temp. and rainfall. The last fortnight was very cold, an inch of S falling on 26th, which in October is most unusual. The mean temp. was 13° below that of September. T on 2nd, 4th, and 15th; T and L on 25th; H on 8 days.

STROUD, UPFIELD.—S.W. gale in morning on 3rd. S fell to a depth of more than half an inch on 21st, melting rapidly, and to a depth of about three-quarters of an inch at night on 26th.

WOOLSTASTON.—The first three weeks were pleasant and genial, but on the 21st S fell heavily to a depth of nearly 6 inches, and it was intensely cold till the end of the month. T and very vivid L on 27th. Mean temp. 44°·2.

TENBURY, ORLETON.—A very cold month, the mean temp. being more than 4° below the average of 34 years, and colder than any October since 1887. Severe frost from the 23rd to 30th inclusive. S on the 22nd and 27th.

LEICESTER, BARKBY.—A great contrast to September, the mean temp. (44°·3) being exactly 15° lower. More than the average R fell; still, the land absorbed it nearly all. S fell on the 26th.

MANCHESTER, PLYMOUTH GROVE.—Very unsettled from the 1st to the 9th; fine autumn weather on 10th and 11th, and from 16th to 20th. Slight S on the 24th and 26th; fog on 28th, and dense fog on 29th; the last ten days very

winterly. On the 24th the min. on grass was 18°, the lowest in October in 28 years, with the exception of 17° on October 27th, 1890.

HULL, PEARSON PARK.—Fog on 1st, 18th, 25th, and 29th. Showers of H, sleet, and S on 26th.

WALES.

HAVERFORDWEST.—The change from the sultry heat and bright sunshine which characterized September was sudden and abrupt. Tempestuous weather prevailed during the first ten days, with a considerable fall of temp. The weather then improved, and the air was still and calm up to the 14th; the temp. then again fell, and weather of a most winterly character set in; several times the Precelly range was white with snow from end to end, and very sharp ground frosts prevailed from the 22nd to the close. Wind generally N.N.W. to N.E. Much T, L, and H.

GOGERDDAN.—Very stormy throughout the month, and very cold during the last ten days, with H and S.

SCOTLAND.

CARGEN.—Warm weather continued until the 1st, from which date the temp. fell rapidly, and the mean (43°·5) has only once been lower (43°·1 in 1892) in 36 years. The highest and lowest readings during the first 3 days were 71°·2 and 35°·6 respectively, giving a range of 35°·6 in 72 hours. On no previous occasion has the temp. exceeded 70° in October. Frost was registered on 12 days, and temperatures below 21°·2 have only twice been noted in October, namely, 19°·4 in 1892 and 21°·0 in 1894. Northerly winds were prevalent to an unprecedented extent, and there was considerably more than the average amount of sunshine. There was curling on 30th in the higher districts of Dumfriesshire and Ayrshire, and no record can be traced of the game having been previously played in October.

JEDBURGH.—The rainfall of the month is nearly twice the average, and the greatest in October for 30 years. The temp. was low, and on the whole the weather was ungenial. Some days in the early part had much sunshine, but there was almost none at the end. S at the end of the month.

COLMONELL.—Rainfall ·17 in. below the average of 19 years. S on 21st. H on 23rd, 25th, 26th, and 27th. Mean temp. (44°·6) 1°·3 below the average.

ABERDEEN, CRANFORD.—The month was cold and wet.

ROEBERRY.—A very cold month. Mean temp. 43°·1. Wind from the 9th to the end of the month, N. to N.E.

IRELAND.

DARRYNANE ABBEY.—Cold, stormy, and wet, a marked contrast to September. Slight aurora on 21st. The mountains white with S on 26th, 27th, and 28th.

WATERFORD, BROOK LODGE.—L on 26th and 27th. T on 13th and 31st. Dense fog on 14th and 15th.

O'BRIENSBRIDGE, ROSS.—Heavy R during the first week, followed by low temperature and frequent slight frosts.

DUBLIN.—A very cold October, with a great preponderance of N.W. winds. The mean temp. was nearly 13° below that of September, the change from the unusual warmth of the end of that month being singularly abrupt, and occurring on the morning of the 2nd. S lay on the Dublin mountains on the 2nd, and also from the 22nd to the end of the month. Mean temp. (46°·2) 3°·5 below the average. TS on 26th. L on 25th, 27th, and 28th. High winds on 9 days, attaining the force of a gale only on 2nd and 3rd. Fog on 7 days. H on 8 days. Sleet on 3 days. Solar halo on 30th.

LONDONDERRY, CREGGAN RESERVOIR.—S daily from 24th to 28th.

EDENFEL, OMAGH.—The first fortnight was wet and unsettled, the third week was very fine, and from the 23rd to the end there followed the coldest spell ever experienced here in October; strong polar winds, with heavy S and sleet and continuous night frosts; notwithstanding which, so great has been the luxuriance of the foliage, that the autumn tints were at least a fortnight later than usual.

[CCLIX.]
XXX.

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SYMONS'S
MONTHLY
METEOROLOGICAL
MAGAZINE.

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DECEMBER, 1895.

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The responsibility for all facts and opinions expressed in the letters published in this Magazine rests with their respective authors.

THE OBSERVATORY:

A Monthly Review of Astronomy.

EDITED BY H. H. TURNER, M.A., B.Sc., SEC. R.A.S.
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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCLIX.] DECEMBER, 1895. [PRICE FOURPENCE, *or 5s. per ann. post free.*

CLIMATE AND HEALTH.*

IT will be strange if the final unravelment of the connection between weather and disease occurs in the New World, which is as but of yesterday, and not in the Old World, where it has been written about for more than two thousand years. Such an event seems to us not improbable.

When the people of the United States make up their minds as to doing anything, they have funds, extent of country, means of intercommunication, and the will to expend those resources, to a greater extent than the nations of the Old World. It is not a question of the relative skill of an individual in one world or the other; but given two men of equal ability, one in England, one in Washington, the latter has far and away the best chance; he has an area twenty times as great, he has a staff of assistants of proportional magnitude, and need not trouble about the cost of printing and engraving.

We have been led to the above remarks by examining the work mentioned below, concerning which we have a little more to say. In the first place, we must own to some amusement, astonishment and grief at the origin of what may not improbably be a work of world-wide importance. We must first justify the rather contradictory sentiments which we have just named, and to do so we must reproduce the first few lines of the Preface.

"In December, 1893, the Honorable the Secretary of Agriculture in a communication to the Chief of the Weather Bureau, enclosed a copy of a monthly report of the Cornwall County (England) Council, and wrote among other things concerning it :—

'Besides meteorological data, it contains vital statistics which may be of service, and may possibly suggest to you some manner by which, through the Weather Bureau of this Department, the sanitary conditions throughout the various States of the Union may constantly be kept before the public.'"

* United States Department of Agriculture, Weather Bureau. Climate and Health. Edited under the direction of Prof. Willis Moore, Chief of the Weather Bureau, by W. F. R. Phillips, M.D. Number One. Washington, 1895, 4to, 26 pages, 20 maps.

We were 'amused' because without in the least depreciating Mr. Trevail's little monthly table, the idea of its setting in motion such an organization as that revealed by the work before us is somewhat droll. We were 'astonished' and 'grieved' because it shows the extreme difficulty of making even those high in office at all aware of what has been done, and is being done, in other parts of world. The whole Preface reads as if the suggestion had for the first time dawned upon the human race. If the Secretary had but gone to another department in his own city of Washington and consulted the superb catalogue issued by the Surgeon-General's Office (a work which has no European rival), he would have learned something as to what has been done; but, perhaps, it is as well not. Prof. Willis Moore (Chief of the Weather Bureau) has wisely placed the editorship in the hands of a medical man (Dr. W. F. R. Phillips) and if he is not hampered with detail, but allowed time to study the facts sent in to him, it is by no means improbable that he may detect hitherto unrecognized relations. A still better plan—and one the cost of which would to the United States be insignificant - would be to offer short (say, three years) appointments to half-a-dozen students who have passed good examinations in Physics *and* in Medicine, and let each have nothing to do with the preparation of tables but, be required to give his whole attention to the distribution of a single disease both geographically and climatologically. It would probably be well to prohibit his publishing any opinion or suggestion within the first year of his appointment; this would prevent the exercise of the natural instinct to bolster up early pronouncements.

As the Preface states that "This first number is almost wholly experimental in the sort of information it contains," we do not enter into details. It is something after the style of the returns of the Registrars General of England, Scotland and Ireland, of the *Tableaux Mensuels de Statistique Municipale* of Paris, and we were about to add the *Tablettes Mensuelles de la Soc. Roy. de Méd. Publique de Belgique*, but, to our astonishment, we find that now they contain no meteorology, although they have a special classification for *Maladies saisonnières, météoriques ou telluriques!* It differs, however, from all the above publications in the number of maps which it contains—good maps, but in which clearness has been lost by endeavouring to convey too much information upon each map.

There is no indication of any price being charged for this publication, and we infer that the United States, with its usual liberality (except as to the Bibliography of Meteorology), would be willing to exchange with the numerous analogous publications in this and other countries.

METEOROLOGICAL OBSERVATIONS IN MANCHURIA.

WE have been favoured by the Rev. Dr. Cairns Mitchell with a copy of a little book with the title "*Ten Years in Manchuria*" (Houlston and Sons), by Mr. Christie, a Presbyterian Medical Missionary, giving an interesting account of his work in that remote part of China; and giving also a summary of his daily meteorological observations during 1893. Mr. Christie gives no details as to the instruments or their position, but observations from that part of China are so scarce, that we thankfully accept this information, and hope that the Mission and the records may both go on successfully.

Meteorological Results for 1893, *Moukden, Manchuria, China.*

Lat. 41° 50′ N.; Lon. 123° 58′ E. Altitude 320 ft.

1893.	Thermometer.					Barometer.	Rainfall.			
	Maximum.		Minimum.		Mean for Month.	Mean.	No. of days.		Max. in 24 Hours.	Total for Month.
	Highest.	Mean.	Lowest.	Mean.			Rain.	Snow.		
	°	°	°	°	°	in.			in.	in.
January ...	40·4	16·3	-28·2	- 9·3	3·5	30·09	...	5	...	·75
February..	37·0	25·5	-25·0	- 5·0	10·3	30·15	...	3	...	·45
March.....	68·0	43·3	- 8·7	20·7	32·0	29·93	1	2	...	·40
April	77·2	63·5	29·0	38·1	50·8	29·69	5	...	·32	·93
May.....	86·9	73·3	32·7	49·0	61·1	29·69	7	...	·65	2·30
June	96·1	83·5	51·9	60·8	72·2	29·56	8	...	2·20	5·27
July.....	95·9	89·0	64·5	70·2	79·6	29·55	6	...	3·26	4·62
August ...	95·2	85·3	48·6	63·8	74·5	29·59	7	...	3·35	4·63
September	86·7	75·5	38·5	50·1	62·8	29·83	5	...	1·72	3·42
October ...	76·1	54·3	23·1	34·7	44·5	29·94	4	2	·80	2·58
November.	54·2	39·7	- 6·9	13·8	26·8	30·01	1	1	...	1·00
December.	47·2	25·4	-17·4	4·0	14·7	30·11	...	5	...	·72
Extremes	96·1	...	-28·2	...	..	..	44	18	3·35	27·07
Means.....	...	56·2	...	32·6	44·4	29·84	...	...	...	...

A WONDERFUL QUEENSLAND RAIN RETURN.

IN the *Met. Mag.* for April and May, 1893, under the heading *Queensland Floods*, we reprinted several very remarkable records of rainfall, and expressed the hope that we might see some official and trustworthy statement by Mr. Wragge. We have heard of his predicting the weather for the whole continent of Australia, and of his starting a mountain station in Tasmania, but we have not seen a single report upon the rainfall of Queensland; and now that a friend has sent us the following, we do not know whether or not it is to be regarded as *the* wettest station in Australia. According to the *Melbourne Argus*, at Crohamhurst, in the Blackall Ranges, 77·31 in. of rain fell in the four days, Jan. 31st—Feb. 3rd, 1893, and at

Mooloolah 67 in. in three days, at about the same date, but as we have had no returns from Queensland of late years, we cannot say whether these stations are or are not wetter than Goondi—to all appearance it is hard to beat—and apparently that part of Queensland has water enough and to spare.

Rainfall at Goondi Mill, Johnstone River, Queensland.

Month.	Total Rainfall for Month.	No. of Days.	Greatest Fall in one day.	Date.	No. of days with 2 in. rain and upwards.
1894.	in.		in.		
January	26·77	25	5·05	16	4
February	24·55	15	7·54	23	6
March	38·36	23	6·40	20	7
April	71·44	25	15·69	6	10
May	8·28	19	1·11	8	...
June	8·61	13	4·53	22	1
July	5·87	11	2·37	2	1
August	6·44	10	2·27	18	2
September	2·38	11	1·20	18	...
October	3·34	16	·82	30	...
November	32·48	20	5·07	21	8
December	12·98	21	1·88	26	...
Total	241·50	209	15·69		39

We have also been favoured by Captain Wilson-Barker, R.N.R., F.R.Met.Soc., with a weekly return for quite another district. We have reduced it, as nearly as practicable, to monthly values and append it. But, as a rule, we think that local returns should always go to the central office of the country. We are sure that Mr. Ellery's successor at Melbourne Observatory would welcome the assistance of Captain Wilson-Barker's correspondent at Warragul.

Rainfall at Fern Hills, Warragul, Victoria, Australia.

Month.	1893.	1894.	1895.
	in.	in.	in.
January	...	·92	1·29
February	...	1·37	·56
March	...	3·35	2·15
April	...	2·45	3·43
May	...	4·37	1·63
June	...	1·87	4·49
July	...	6·39	4·35
August	...	6·09	4·16
September	6·80	3·92	...
October	3·77	3·45	...
November	3·17	·33	...
December	4·91	2·75	...
Total	...	37·26	...

Snow on 21st and 22nd July, 1895.

THE CLIMATE OF THE BRITISH EMPIRE IN 1894.

The Climatological Table and Summary for 1894 show many familiar features, and the extremes are mostly distributed among the usual stations. Australia records the highest shade temp., and Winnipeg, of course, the lowest. In the 12 years for which the annual summaries have appeared in this magazine, Adelaide has yielded the highest max. in 10 years, Melbourne in one, and Calcutta in one; Adelaide also has, in nine years, recorded the highest sun max.

Winnipeg has never been equalled for lowness of absolute shade min., and of mean temp., or for total range of temp., and has only twice failed to record the greatest mean daily range. As regards mean temperature, Ceylon, with values ranging only from 80°·2 in 1887 to 81°·1 in 1885, has always headed the list.

The least daily range has generally been recorded at a thoroughly insular station, but Bombay in one year—1892, was bracketed with Ceylon.

The lowest relative humidity has invariably occurred at Adelaide, while the highest relative humidity has in different years been recorded at Falkland Isles, Winnipeg, Barbados, London and Esquimalt.

The greatest rainfall has in six years been registered at Ceylon, three at Bombay, and three at Trinidad; while the least rainfall has been distributed among six stations—Adelaide, Melbourne, Malta, Winnipeg, Jamaica and London.

Malta comes out well at the head of the list for cloudlessness, having recorded the least in eight years, Bombay in four, and Calcutta in one.

These comparisons are, to a certain extent, affected by the changes that have occurred from time to time in the list of stations, but the great majority extend over the whole period. The Cape of Good Hope appeared from the commencement of the tables in "*The Colonies*" in 1874 very regularly for many years, but we have very reluctantly had to abandon it, for of late all our efforts to obtain regular returns have failed.

To return to the 1894 results. The shade max. at Adelaide, 107°·0, has been exceeded in ten years, but the min. at Winnipeg, —46°·1, and the extreme range at the same station, have only twice been beaten.

Winnipeg, with a mean temp. of 36°·5, can hardly be congratulated on having had a *warm* year, though that value is the highest for that station shown in the 12 years.

The max., in sun, at Trinidad, 177°·0, has been exceeded only by 180°·0 at Adelaide in 1882.

The extreme rainfall (77·46 in.) at Ceylon is, with one exception, the smallest in the 12 years, but the least rainfall is not remarkable.

Curiously enough, London and Esquimalt record the greatest amount of cloud, and each has done the same in two previous years

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1894.

Stations. *Those in Italics are South of the Equator.*	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date	Average. Max.	Average. Min.	Average. Mean.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Average. Cloud.
	°		°		°	°	°	°		°	°	in.		0—10
England, London ...	88·2	July 6	13·1	January 5	58·1	43·2	50·7	43·9	81	128·2	14·3	27·94	185	6·3
Malta	96·3	July 12	41·7	March 29	72·7	59·3	66·0	56·4	76	147·5	35·5	25·16	90	4·6
Mauritius	86·4	January 6	56·8	June 11	79·2	68·5	73·9	64·7	76	138·1	44·6	48·91	196	5·7
Calcutta	105·1	May 17	50·1	January 9	86·4	71·0	78·7	70·7	79	159·7	41·0	48·66	96	4·2
Bombay	93·0	June 1	64·0	December 15	85·6	75·0	80·3	71·9	76	142·5	54·5	66·85	124	4·0
Ceylon, Colombo ...	91·8	February 14	66·0	January 29	86·4	75·2	80·8	71·8	78	153·5	54·0	77·46	183	5·7
Melbourne	105·7	November 27	31·7	July 11	67·5	50·5	59·0	49·5	73	152·1	27·0	22·61	138	6·0
Adelaide.....	107·0	November 26	37·2	July 8, Sep. 6	72·4	53·0	62·7	48·6	63	165·0	30·7	20·80	134	4·8
Sydney	97·5	November 26	40·4	July 11	69·5	56·7	63·1	53·2	75	156·2	27·9	38·24	188	4·8
Wellington	80·0	Jan. 13, 15 / February 23 / December 30	33·3	August 6	62·4	50·5	56·5	47·6	73	145·0	21·0	51·01	162	4·7
Auckland	82·0	January 27	35·0	September 3	66·2	53·3	59·8	52·8	78	148·0	30·0	41·11	180	5·4
Jamaica, Kingston..	92·9	June 22 / July 17 / September 21	61·2	March 9	86·8	70·3	78·5	69·1	78	...	...	34·91	83	4·2
Grenada	88·5	February 8	67·0	Mar. 7, Apl. 3	82·9	73·3	78·1	69·5	74	164·5	...	67·88	256	4·0
Trinidad.....	95·0	February 2 / March 2 / May 13	60·0	March 23	87·8	69·1	78·5	69·8	78	177·0	59·0	52·30	...	...
Toronto	90·7	June 26	— 9·9	February 24	54·9	38·6	46·8	39·6	75	...	—11·2	29·58	185	6·0
Manitoba Winnipeg	95·8	July 16	—46·1	January 24	48·1	25·0	36·5	...	...	...	...	18·12	134	5·3
British Columbia, Esquimalt	84·0	July 12	—20·2	February 19	54·0	41·4	47·7	43·8	88	...	...	42·79	213	6·3

Summary.

Highest Temp. in Shade	...	107°·0 at Adelaide on Nov. 26.
Lowest „ „	...	—46°·1 at Winnipeg on Jan 24.
Greatest Range in year ...	...	141°·9 at Winnipeg.
Least „ „ ...	...	25°·8 at Colombo, Ceylon.
Greatest Mean Daily Range	...	23°·1 at Winnipeg.
Least „ „	...	10°·6 at Bombay.
Highest Mean Temp. ...	...	80°·8 at Colombo, Ceylon.
Lowest „ „ ...	...	36°·5 at Winnipeg.
Driest Station	...	Adelaide, mean humidity 63.
Dampest Station... ...	...	Esquimalt mean humidity, 88.
Highest Temp. in Sun ...	...	177°·0 at Trinidad.
Lowest Temp. on Grass...	...	—11°·2 at Toronto.*
Greatest Rainfall ...	...	77·46 in. at Colombo, Ceylon.
Least „ ...	...	18·12 in. at Winnipeg.
Most Cloudy Stations ...	...	London and Esquimalt; average amount 6·3.
Least „ „ ...	...	Bombay and Grenada; average amount 4·0.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of the session was held in the new building of the Institution of Civil Engineers on Wednesday evening, November 20th, Mr. R. Inwards, F.R.A.S., President, in the Chair.

Mr. W. H. Dines, by the aid of a small fan fixed over a vessel of hot water shielded from draughts, showed an experimental illustration of the formation of a "Tornado cloud," or waterspout. The characteristic funnel cloud was readily seen extending from the tray of hot water to the fan, and when the draught was strong and the conditions were favourable, a decided protuberance was observed on the surface of the water just under the end of the cloud. Mr. Dines is of opinion that the cloud is formed by true dynamic cooling, as the air saturated by the vapour from the hot water comes under the influence of the decreased pressure at the centre.

The President, Captain Wilson-Barker, Messrs. Bayard, Tripp, Marriott, Dickson, Symons and Admiral Maclear took part in the discussion, and all who had seen the phenomena in nature spoke of the wonderful fidelity of the representation.

A paper by Mr. J. Eliot, F.R.S., followed "On the origin of the cold weather storms of the year 1893 in India, and the character of the air movement on the Indian Seas and Equatorial Belt, more especially during the South-west Monsoon period." This was a discussion of the data contained in the *Indian Monsoon Area Charts*, the

* The min. on grass is not recorded at Canadian Stations, except Toronto.

publication of which was sanctioned by the Indian Government for the two years 1893–4. Cyclonic storms are of frequent occurrence during both the N.E. and the S.W. Monsoons, but they differ in many important respects. The storms of the S.W. Monsoon originate almost invariably over a sea surface, and travel in very variable directions, and occasionally develop into intense and furious hurricanes. The cyclonic storms of the N.E. Monsoon almost invariably originate over the plateau of Persia or Baluchistan, or in North-Western India, and travel in an easterly direction at a velocity ranging between 15 and 20 miles an hour. These plateau-formed storms of the cold weather are the chief instruments of the distribution of the moderate rainfall essential for the great cold weather wheat and other crops of Northern India—and are the chief sources of the snowfall of the Western Himalayas. After giving an account of the more important cold weather storms in January and February, 1893, and the results of the tabulation of the wind observations for the Equatorial Belt, the author describes the "burst of the Monsoon." Mr. Eliot says that the evidence of the year 1893 is strongly in favour of the supposition that the S.W. Monsoon currents in the Indian Seas are the direct continuation, north of the Equator, of the horizontal movement of the S.E. Trade Winds; and that the larger variations in the strength of the S.E. Trades near the Equator during the Monsoon period are reproduced in the Monsoon currents in the Indian Seas from June to September.

Mr. Baldwin Latham, while appreciating the value of the paper, did not think that it fully cleared up the matter. Mr. Scott said that an examination of the Monsoon Charts which were in the library of the Meteorological Office showed the great deficiency of observations over the sea. The Indian Government, in view of the importance of the subject, had authorized the issue of the Charts for three more years. Captain Wilson-Barker dwelt upon the extent and importance of the work and considered that the weak point was the scarcity of observations over the sea; he thought, that the effect of the Himalayas was hardly sufficiently taken into account. Mr. C. Harding spoke with great appreciation of the paper and of the foresight which Mr. Blanford has shown in arriving, from the imperfect evidence available in the absence of synoptic charts, at a similar conclusion to the author. He gave illustrations of the manner in which meteorologists might be misled by working entirely with mean values. Mr. H. N. Dickson thought that Mr. Eliot's work would be greatly aided by a knowledge of the conditions prevailing on the Northern side of the Himalayas.

A paper, by Mr. C. Davison, F.G.S., "On the Diurnal Variation of Wind Velocity at Tokio, Japan," was also read.

REVIEWS.

The English Lakes, with Bathymetrical Maps and Illustrations, by HUGH ROBERT MILL, D.Sc., F.R.S.E. [From the *Geographical Journal.*] G. Philip and Son, London, 1895, large 8vo., 64 pages, 20 engravings and 8 large, folding, coloured maps.

IT is very curious how frequently volunteer work is better than that produced by Government officials who, having National money to spend are unfettered as to cost.

This fascinating paper is a good illustration of what we have just said. As far as we can ascertain its origin is as follows :—Dr. Mill felt that it was a national disgrace that no survey had been made of the English Lakes. Their position and the configuration of the water surface had been laid down with absolute precision on the 6-inch Ordnance Maps, approximate statements as to the greatest depth in each lake had been given in *Black's Guide to the Lakes*, and a few soundings in some of them by Crosthwaite in 1792, and on some of the 6-inch Geological Survey Maps, but nothing of a complete nature had been done. Dr. Mill undertook to do it without remuneration, provided that the Royal Geographical Society would defray actual expenses ; the Society accepted the offer, and Dr. and Mrs. Mill and Mr. Heawood have done the work in a style worthy of all praise.

GENERAL VIEW OF DERWENTWATER FROM THE NORTH.

[*Photograph by Mr. A. Pettitt, Keswick.*

Although the book contains a mass of statistics it must not be assumed to be dry reading, quite the contrary, and whether one's tastes be merely æsthetic, or meteorological, or geological or cartographical, in each case we could strongly recommend the securing of a copy while any are to be had. We had occasion recently to refer to the beauty of Bartholomew's colour map printing, and the eight maps given here are worthy of their reputation, there is a general one of the country, and there are seven detail ones on the scale of two inches to the mile which leave nothing to be desired. As to the illustrations we have the pleasure of reproducing one of the twenty to speak for itself.

The paper is clearly and pleasantly written and should, we think, be read by all who take an intelligent interest in the most beautiful country in the British Isles.

As an indication of the thoroughness with which the work was done we find that the depth of the water was determined at 5068 spots along lines of soundings the aggregate length of which was 153 miles.

Clouds and Weather. A study for navigators by CAPTAIN D. WILSON BARKER, F.R.S.E., F.R.Met.Soc. *Shipping World* Office, Arundel Street, Strand, 1895. 8vo., 22pp.

TWENTY-FOUR reproductions of photographs of clouds, a page of diagrams and the needful text offered at sixpence can hardly be accused of being costly. The little pamphlet is written for sailors by a sailor who has had wide experience and has made good use of it. The blocks are produced from Captain Wilson Barker's own photographs and have apparently been printed upon a newspaper printing machine, some have come out remarkably well, but others do not do justice to the photographs.

Meteorologische Volksbücher, VON PROF. DR. HELLMAMN. Second ed. Paetel, Berlin, large 8vo, 68 pages.

WE pointed out the excellence of this work when the first edition appeared; our verdict has been confirmed by the sale of the whole edition, and the appearance of a second. It is considerably enlarged and brought thoroughly up to date. For instance, Firmin de Belleval is duly credited with the treatise, "De mutatione aeris," &c, ; but there is no more information about Joannes de Sacro Bosco. We, as Englishmen, ought to find out more than was given in the *Met. Mag.*, Vol. xxvi. (1891), p. 133–134. Will one of our readers take it up? Some Yorkshireman might search for records of the Twelfth-century astronomer.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	86·2	30	35·7	2	68·3	46·0	45·1	68	128·9	30·2	·34	5	4·0
Malta	81·6	24	53·1	9	72·7	59·3	57·2	75	136·6	47·4	·51	3	5·8
Mauritius	81·9	3	66·2	27*b*	78·3	70·4	65·9	78	129·2	55·3	3·09	21	5·1
Calcutta	107·2	20	70·2	4	96·2	79·1	77·9	74	159·2	68·9	2·41	4	4·1
Bombay	91·8	19	78·3	4	90·3	80·6	75·0	73	140·9	73·7	·08	2	3·0
Ceylon, Colombo	93·7	1	74·6	16	89·4	78·7	74·0	78	157·0	68·0	10·09	25	7·0
Melbourne	66·3	3	31·3	26	59·7	45·7	45·5	76	119·0	26·7	·97	15	7·1
Adelaide	71·7	13	36·9	26	63·5	47·6	45·9	70	132·0	29·6	·84	9	5·3
Sydney	71·2	14	43·1	27	63·9	51·4	49·0	82	120·3	34·3	1·87	15	5·0
Wellington	65·0	9	39·0	19*c*	57·6	47·0	43·7	73	109·0	27·0	4·70	15	5·0
Auckland	68·0	2	43·0	23	61·8	51·3	48·8	76	129·0	37·0	5·52	21	6·5
Jamaica, Kingston	89·5	14	70·4	4	87·8	73·2	71·1	76	...	...	1·98	8	4·6
Trinidad	95·0	11	65·0	20	90·3	70·4	69·7	70	169·0	64·0	2·11	9	...
Grenada	85·0	18*a*	71·0	3	83·0	74·6	69·3	71	149·6	...	3·41	19	4·6
Toronto	93·4	30	27·9	13	62·3	44·5	44·6	70	...	23·0	2·31	8	4·3
New Brunswick, Fredericton	91·7	7	26·5	2	67·8	41·5	43·1	61	...	...	·95	16	5·5
Manitoba, Winnipeg	80·0	22	24·8	13	67·3	40·8	...	...	...	...	3·74	13	6·4
British Columbia, Esquimalt	82·0	16	36·1	5	61·1	44·1	47·3	87	...	...	1·60	17	6·1

a—24 and 26; *b*—and 29; *c*—and 23.

REMARKS.

MALTA.—Adopted mean temp. (64°·9), 0°·8 above the average. Mean hourly velocity of wind 8·9 miles. Temp. of sea rose to 70°·0. Thunderstorms on 5th and 6th. Lightning on 9th and 10th. Hail on 5th. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·0 above, of dew point 1°·6 above, and rainfall ·91 in. below, their respective averages. Mean hourly velocity of wind 13·0 miles, or 3·0 miles above average; extremes, 30·2 on 6th, and 1·8 on 11th; prevailing direction, E.S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms on nine days, and lightning on five other days. D. G. MANTELL.

Adelaide.—Mean temp. 2°·1 below the average of 38 years. Very dry; rainfall 2·10 in. below the average. C. TODD, F.R.S.

Sydney.—Mean temp. 0°·7 below, humidity 7 above, and rainfall 3·27 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—A few fine days during the early and latter parts of the month, but generally showery and unpleasant weather and cold, with prevailing S. and S.E. winds. Hail on 17th. Fog on 14th, 21st and 22nd. Mean temp. 0°·3 above, and rainfall ·29 in. below, the average. R. B. GORE.

Auckland.—An unusually rainy May, the rainfall being 1·41 in. over the average of 28 years. Mean temp. and barometrical pressure both slightly below the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·4 miles. Rainfall in N and W.C. divisions 43 and 9 per cent. above, and in N.E. and S. divisions 19 and 26 per cent. below, the respective averages, giving as the result an average fall for the island. R. JOHNSTONE.

TRINIDAD.—Rainfall 1·54 in. below the average of 30 years. J. H. HART.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	83·9	23	42·2	15	73·6	50·6	47·6	62	135·3	34·4	·30	4	4·8
Malta	88·1	29	57·1	1	79·2	65·1	62·7	75	139·9	51·0	·00	0	3·2
Mauritius	77·6	3	54·8	22	74·8	65·6	61·2	75	123·2	45·6	2·85	19	5·5
Calcutta	95·3	14	72·8	1	90·1	77·7	78·4	84	157·8	71·3	11·82	16	6·4
Bombay	93·8	7	75·1	20	88·0	79·8	77·2	82	143·4	73·7	17·84	20	7·0
Ceylon, Colombo	90·2	11	73·6	14	87·9	77·5	74·3	82	151·5	70·0	13·99	24	6·1
Melbourne	66·1	6	29·5	17	57·6	42·6	42·7	78	114·1	20·4	1·74	13	6·4
Adelaide	68·5	6	39·6	5	61·0	46·7	46·1	75	129·0	31·5	2·89	16	5·8
Sydney	70·0	20	41·8	30	61·2	47·6	43·2	77	106·3	28·7	·93	13	3·8
Wellington	62·8	10	32·5	21	54·4	43·2	41·5	77	103·0	22·0	9·53	23	5·9
Auckland	63·0	12	40·0	21	58·3	48·4	46·0	76	116·0	36·0	6·14	25	6·6
Jamaica, Kingston	91·9	17*a*	69·7	1	89·0	73·4	69·7	70	..	...	·32	3	4·2
Trinidad	91·0	7	67·0	13*b*	88·6	70·3	70·6	76	171·0	66·0	5·00	13	...
Grenada	85·6	4	71·0	19	82·7	74·1	72·4	76	148·5	..	6·20	24	5·1
Toronto	93·1	2	45·8	8	79·0	56·7	55·6	67	109·5	39·4	·75	9	3·8
New Brunswick, Fredericton	91·7	12	37·5	9	77·5	51·3	50·1	57	...	...	2·86	11	4·6
Manitoba, Winnipeg	80·0	16	34·8	26	69·5	47·6	...	...	...	...	2·31	18	7·5
British Colombia, Esquimalt	75·2	7	39·4	2	65·3	48·4	52·8	89	...	...	·48	11	5·4

a—and 18; *b*—and 29.

REMARKS.

MALTA.—Mean temp. 71°·0, 0°·6 below average; mean hourly velocity of wind 10·4 miles. Average temp of sea, 74°·0. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·1 below, of dew point 0°·6 above, and rainfall ·81 in. above, their respective averages. Mean hourly velocity of wind 12·8 miles, or 1·4 mile above average; extremes, 29·6 on 11th and 2·0 on 9th; prevailing direction E.S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on the 5th and 10th, and thunderstorms occurred on 8 days. D. G. MANTELL.

Adelaide.—Mean temp. 0°·3 above, and rainfall ·10 in. above, the average of 38 years. C. TODD, F.R.S.

Sydney.—Mean temp. same as the average; humidity 1 below, and rainfall 4·46 in. below, the average. H. C. RUSSELL, F.R.S.

Wellington.—Showery in the early part of the month, then a few fine days until 11th, when it rained heavily (2·27 in.), and continued showery almost for the remainder of the month. Wind variable and on the whole moderate. H on 18th and 19th. Fog on 16th, 17th, and 29th. Rainfall nearly twice the average. R. B. GORE.

Auckland.—An exceptionally wet and stormy month, the rainfall being nearly 1·50 in. above the average. Barometric pressure and mean temperature both slightly under the average. T. F. CHEESEMAN.

JAMAICA.—Mean hourly velocity of wind 4·9 miles. Rainfall very deficient, being only half the average in the N. and W.C. divisions, and less than half in the N.E. and S. divisions. Hail at Kew Park on 28th, and at Vale Royal on the 6th, stones in the latter case being $\frac{3}{4}$ inch in diameter, and tasting salt. Vale Royal is 3 miles from the sea, at an elevation of about 800 ft. R. JOHNSTONE.

TRINIDAD.—Rainfall 3·04 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall .	5 67	XI.	Lake Vyrnwy	7·51
,,	Birchington, Thor	2·99	,,	Corwen, Rhug	4·81
,,	Hailsham	5·43	,,	Carnarvon, Cocksidia ...	6·50
,,	Ryde, Thornbrough	4·70	,,	I. of Man, Douglas	3·81
,,	Emsworth, Redlands ...	5·23	XII.	Stoneykirk, Ardwell Ho.	4·29
,,	Alton, Ashdell	6·02	,,	New Galloway, Glenlee	7·34
III.	Oxford, Magdalen Col..	4·17	,,	Melrose, Abbey Gate .	...
,,	Banbury, Bloxham	4·94	XIII.	N. Esk Res. [Penicuick]	3·50
,,	Northampton, Sedgebrook	3·72	,,	Edinburgh, Blacket Pl..	2·60
,,	Alconbury	3·14	XIV.	Glasgow, Queen's Park..	4·08
,,	Wisbech, Bank House...	2·90	XV.	Inverary, Newtown	8·35
IV.	Southend	3·27	,,	Islay, Gruinart Schools..	4·63
,,	Harlow, Sheering..... ...	3·39	XVI.	Dollar.....	4 02
,,	Colchester, Lexden	2·03	,,	Balquhidder, Stronvar...	11·68
,,	Rendlesham Hall	1·87	,,	Ballinluig	5·57
,,	Diss	2 01	,,	Dalnaspidal H.R.S.....	9·18
,,	Swaffham	3 07	XVII.	Keith H.R.S.....	1·39
V.	Salisbury, Alderbury ...	5·97	,,	Forres H.R.S.	·91
,,	Bishop's Cannings	5·85	XVIII.	Fearn, Lower Pitkerrie..	·40
,,	Blandford, Whatcombe .	7·09	,,	Loch Shiel, Glenaladale	...
,,	Ashburton, Holne Vic...	13·03	,,	N. Uist, Loch Maddy ...	4·45
,,	Okehampton, Oaklands.	8 00	,,	Invergarry.....	6·93
,,	Hartland Abbey	5·19	,,	Aviemore H.R.S.	2·68
,,	Lynmouth, Glenthorne.	7·33	,,	Loch Ness, Drumnadrochit	2·88
,,	Probus, Lamellyn	6·44	XIX.	Invershin	·79
,,	Wellington, Sunnyside..	...	,,	Scourie	3·02
,,	Wincanton, Stowell Rec.	6 55	,,	Watten H.R.S.....	1·60
VI.	Clifton, Pembroke Road	5·38	XX.	Dunmanway, Coolkelure	10·92
,,	Ross, The Graig	4·80	,,	Fermoy Gas Works	...
,,	Wem, Clive Vicarage ...	2·45	,,	Killarney, Woodlawn ...	7·94
,,	Cheadle, The Heath Ho.	3·62	,,	Caher, Duneske	6·05
,,	Worcester, Diglis Lock	3·25	,,	Ballingarry, Hazelfort...	4·71
,,	Coventry, Coundon	4·93	,,	Limerick, Kilcornan ...	4·87
VII.	Ketton Hall [Stamford]	3·59	,,	Ennis	...
,,	Grantham, Stainby	3·86	,,	Miltown Malbay	...
,,	Horncastle, Bucknall ...	2·60	XXI.	Gorey, Courtown House	5·06
,,	Worksop, Hodsock Priory	3·07	,,	Athlone, Twyford	4·78
VIII.	Neston, Hinderton	2·87	,,	Mullingar, Belvedere ...	4·25
,,	Preston, Haighton	...	,,	Longford, Currygrane...	3·95
,,	Broughton-in-Furness ...	4·95	XXII.	Woodlawn	5·61
IX.	Ripon, Mickley.....	5·07	,,	Crossmolina, Enniscoe ..	5·96
,,	Melmerby, Baldersby ...	4·06	,,	Colloony, Markree Obs.	3·72
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton ...	4·93	XXIII.	Lough Sheelin, Arley...	3·90
X.	Haltwhistle, Unthank...	3·24	,,	Warrenpoint.....	4·29
,,	Bamburgh	2·47	,,	Seaforde..	4·95
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	3·25
XI.	Llanfrechfa Grange	6·76	,,	Bushmills, Dundarave..	2·61
,,	Llandovery	6·20	,,	Stewartstown	3·46
,,	Castle Malgwyn	6·08	,,	Buncrana	3·97
,,	Builth, Abergwessin Vic.	10·40	,,	Lough Swilly, Carrablagh.	4·62
,,	Rhayader, Nantgwillt ...	9·14			

NOVEMBER, 1895.

STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Date	Min. Deg.	Da
	inches.	inches.	in.						
London (Camden Square) ...	3·17	+ ·51	·58	28	19	63·5	16	32·0	1
Maidstone (Hunton Court)...	4·77	+ 1·84	·48	3	22	...	...	...	
Strathfield Turgiss	5·12	+ 2·40	·84	5	24	63·5	16	27·3	1
Hitchin	3·83	+ 1·15	·95	5	20	63·0	16	28·0	2,
Winslow (Addington)	4·88	+ 1·95	·98	10	21	62·0	16	27·0	1
Bury St. Edmunds (Westley)	2·66	+ ·11	·39	22	16	62·0	16	31·0	1
Norwich (Brundall)	2·67	...	·47	5	21	62 8	16	28·0	
Weymouth(LangtonHerring)	5·85	+ 2·19	·98	4	22	59·0	16	34·0	2
Torquay (Cary Green)	7·98	...	1·35	10	20	64·1	16	37·2	1
Polapit Tamar [Launceston]..	7·25	+ 2·91	1·07	5	23	62·0	16	29·4	1
Stroud (Upfield)	5·02	+ 1·69	·67	10	25	60·0	16	33·0	1
ChurchStretton(Woolstaston)	4·31	+ ·79	1·23	10	24	58·0	16	31·0	2
Tenbury (Orleton)	4·70	+ 1·56	·91	10	22	62·0	16	26·3	1
Leicester (Barkby)	3·63	+ 1·34	·68	29	24	63·0	16	27·0	1
Boston	2·12	— ·08	·38	10	14	60·0	16	30·0	1
Hesley Hall [Tickhill].....	3·06	+ 1·04	·61	29	21	62·0	16	26·0	1
Manchester(PlymouthGrove)	2·42	— ·58	·43	16	19	60·0	16	30·0	1
Wetherby (Ribston Hall) ..	2·55	+ ·48	·32	6	15	...	...	...	
Skipton (Arncliffe)	7·48	+ ·73	·97	16	21	..	...	...	
Hull (Pearson Park).	2·25	+ ·24	·41	27	17	63·0	16	25·0	1
Newcastle (Town Moor)	2·42	+ ·02	·43	5	17	...	...	...	
Borrowdale (Seathwaite).....	11·57	— 3·22	2·29	10	18	...	...	...	
Cardiff (Ely).....	5·14	+ ·23	1·01	5	21	...	...	...	
Haverfordwest	5·10	— ·76	·77	15	27	59·4	16	30·0	1
Aberystwith (Gogerddan) ...	3·14	— 1·97	·66	10	19	56·0	8*a*	21·0	
Llandudno.....	3·71	+ ·62	·70	16	17	63·4	15	32·0	
Dargen [Dumfries]	6·61	+ 2·05	·86	9, 21	18	57·6	15	28·2	
Jedburgh (Sunnyside).....	2·83	+ ·33	·51	16	17	55·0	10*b*	27·0	
Colmonell	5·69	...	1·20	9	15	55·0	10	22·0	
Lochgilphead (Kilmory)	6·67	— ·62	·91	5	20	...	...	27·0	
Mull (Quinish).....	6·54	— ·45	·90	10	21	...	...	...	
Loch Leven Sluices	3·70	— ·26	·50	22	18	...	...	...	
Dundee (Eastern Necropolis)	2·75	+ ·05	·65	21	21	54·1	11	26·5	
Braemar	3·74	— ·84	1·00	10	18	51·0	11	20·6	
Aberdeen (Cranford)	3·95	...	·75	10	17	55·0	7, 10	25·0	
Strathconan [Beauly]	5·41	— 1·15	·90	16	14	...	...	...	
Glencarron Lodge.....	7·05	...	·86	7	19	58·0	6	23·0	
Dawdor [Nairn]	1·53	— 1·32	·40	22	15	...	...	...	
Dunrobin	2·02	— ·81	·40	6, 21	12	51·0	7	28·5	
S. Ronaldsay (Roeberry).....	2·18	— 1·24	·60	10	18	51·0	10	34·0	
Darrynane Abbey.....	6·52	...	1·14	15	25	...	...	...	
Waterford (Brook Lodge) ...	6·20	+ 2·53	1·20	15	22	59·0	28	28·0	
O'Briensbridge (Ross)	3·34	...	·54	15	20	...	...	...	
Carlow (Browne's Hill)	4·77	+ 1·71	·77	15	18	...	...	...	
Dublin (FitzWilliam Square)	3·58	+ ·75	·89	15	21	58·8	15	34·3	
Ballinasloe	4·83	+ ·92	·65	15	22	53·0	7, 21	31·0	
Clifden (Kylemore)	7·58	...	1·11	10	23	...	...	...	
Waringstown	3·29	+ ·19	·52	15	20	58·0	7	29·0	3
Londonderry (Creggan Res.).	3·14	— 1·38	·55	10	22	...	...	...	
Omagh (Edenfel)	4·56	+ ·69	·95	10	21	53·0	10	29·0	

+Shows that the fall was above the average; —that it was below it.

(a—and 15, 18 ... and 25

METEOROLOGICAL NOTES ON NOVEMBER, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather was very changeable at the commencement of the month, R falling daily, with strong S. or W. gales, especially about the 5th, and again on the 10th, 15th, and 23rd. A break in the stormy weather occurred on the 24th, followed by a dull foggy period. Trees bare of leaves by the 13th. T on 11th.

ADDINGTON.—Rainfall the greatest, and max. temp. in shade the highest, ever registered here in November. A very open month; frost in the shade on only three days. High wind on 10th, 24th, 25th, and 26th. Dense fog on 4th and 22nd.

BURY ST. EDMUNDS, WESTLEY.—A very mild, foggy month, with very little sunshine and more R than usual. Distant L at night on 11th; S on 22nd.

NORWICH, BRUNDALL.—An exceedingly mild month, the mean temp. (46°·7) being about 4° above the average. The max. rose to 60°·8 on the 15th and 62°·8 on the 16th, the last-named reading being the highest ever recorded in November by the observer. Fog in the evening on 1st; S.W. gale on 6th, and southerly gales on 10th and 16th. High wind from N. or N.E. on 23rd, 24th, and 25th. L on 11th.

WEYMOUTH, LANGTON HERRING.—A very wet and mild month. Average temp. at 9 a.m. (47°·9) 3°·6 above the average of 23 years. The weather was very stormy on the 10th, 16th, and 24th. Dense fog on the 8th, and fogs on the 7th, 22nd, and 27th. T and L on the 12th. The average min. is no less than 2°·2 higher than the average min. of October.

TORQUAY, CARY GREEN.—R 3·98 in. above the average. Mean temp. (50°·3) 3°·1 above the average. Duration of sunshine 47 hours, being 14 hours 40 minutes below the average; 8 sunless days.

POLAPIT TAMAR [LAUNCESTON].—An abnormally wet month. It was generally warm, the average max. shade temp. being 54°·1, and also rather stormy. Fog on 4 days. T on 9th and 11th. Gales from S.S.W. on 10th, and S.S.E. on 15th and 16th.

STROUD, UPFIELD.—S.W. gales on 5th, 6th, 10th, 15th, and 16th; E. gale on 25th. T and L on 5th, 11th, and 12th.

WOOLSTASTON.—A wet and stormy month. Heavy gales on 5th, 10th, 15th, and 16th. Only six days without rain. Mean temp. 43°·8.

TENBURY, ORLETON.—A wet, warm month. With the exception of 1888, the wettest November since 1852. Mean temp. 3°·3 above the average of 34 years. Heavy T on 14th. Gales on 10th, 14th, and 25th. Fog on 8 days.

LEICESTER, BARKBY.—Continuous wet, but no heavy falls of R. Not much frost, and none severe. Mean temp. 44°·7.

MANCHESTER, PLYMOUTH GROVE.—Mean temp. 44°·5.

ARNCLIFFE.—A very wet month, with temperature higher than usual.

SEATHWAITE.—T and L at 6.30 p.m. on 13th. T and L and H at 4.15 p.m. on 14th. Fog on 7th, 11th, 20th, 22nd, 28th, and 30th.

WALES.

HAVERFORDWEST.—The unusual severity of the weather at the end of October changed in character on the advent of this month to mildness and constant R, and on several occasions it was very stormy, especially from the 9th to the 14th. An almost entire absence of frost was characteristic of the whole month, and R fell on 27 out of the 30 days. Prevailing winds S.S.E., S.W., and W.

ABERYSTWITH, GOGERDDAN.—Gales and strong winds from S.E. from 6th to 16th, and from N.E. from 24th to 26th.

SCOTLAND.

CARGEN [DUMFRIES].—A very unsettled month. Gales were experienced on 10th and 15th, the one on the latter date being exceptionally severe and causing considerable damage throughout the district. The mean temp. of the month slightly exceeds that of October, and is 1°·9 above the average. It is somewhat remarkable that while the number of hours of sunshine during this month is 5 less than the average for November for 36 years, it exceeds the average of the preceding 10 years by 11, the average sunshine for the years 1885–94 being only 54 hours. T and L were noted on the 14th. The open weather has been very favourable to the turnip crop, which exceeds all anticipations, and pastures still afford a fair "bite." S.W. gale on 10th and severe gale on 15th.

JEDBURGH.—The weather has shown no peculiarities during the month; on the whole it has been mild, except on the 11th, and it has been calm and dull. All out-door work has gone on unchecked.

COLMONELL.—Rainfall ·42 in. more than the average of 19 years. Mean temp. (43°·5) 2°·8 above the average.

ABERDEEN, CRANFORD.—Strong gales on the 10th, 16th and 21st.

S. RONALDSAY, ROEBERRY.—Upon the whole a fair month. Strong gales from S.W. on the 11th, and from the S. on the 15th and 20th. Mean temp. 42°·3.

IRELAND.

DARRYNANE ABBEY.—A very wet month, and warm, except a few days in the middle. One vivid flash of lightning on 16th with loud thunder.

WATERFORD, BROOK LODGE.—Heavy fog on 3rd and 4th. Gale from S.W. on 5th, and heavy gale on 10th. T and L on 14th.

DUBLIN.—November proved an open, dull, squally and rainy month. It was perceptibly warmer than October, and no frost was recorded in the screen. On the grass the thermometer fell to, or below, 32° on 5 nights only, compared with 12 nights in October. The range of pressure was great—nearly two inches. Only twice in the last 30 years has November been milder than in the present year—in 1881, when the mean was 50°·3, and in 1894, when it was 47°·8. The mean temp. (47°·0) is 2°·3 above the average. High winds were noted on 15 days, and attained the force of a gale on seven occasions. The atmosphere was more or less foggy on 6 days. Lunar halos were seen on the 4th and 30th. H fell on the 16th.

KYLEMORE HOUSE.—Very stormy in the second week, with T and L on the 11th, and T, L and H on 13th.

OMAGH, EDENFEL.—A typical November, with rainfall considerably, and temperature somewhat, above the average, accompanied during the second week by strong S.W. gales.

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THE OBSERVAT

A Monthly Review of Astronom

EDITED BY H. H. TURNER, M.A., B.Sc
(Savilian Professor of Astronomy,
T. LEWIS, F.R.A.S., AND H. P. HOLLI

Contains full Reports of the Meetings of the Royal
Meteorological Societies, and of the British Astronom
by various eminent Astronomers, English, Amer
Correspondence on topics of interest connected with
Observatories, Publications and current Discoveries
Variable Stars, on Lunar Formations, etc., also are
and direction of observers.

The Observatory was founded in 1877, and has become a
Publication.—Prof. Young, in "Ten Years' progress in Astro
All communications should be addressed to the Edi
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SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCLX.] JANUARY, 1896. [PRICE FOURPENCE, or 5s. per ann. post free.

HIGH BAROMETRIC PRESSURE, JANUARY 9TH, 1896.

WHEN, in January, 1882, the pressure in London exceeded 30·9 in., Mr. Sowerby Wallis undertook to prepare for the Royal Meteorological Society an account of the phenomenon. He wrote the paper which occupies pages 146 to 154 of Vol. viii. of the Society's *Quarterly Journal*. We purpose extracting some of the leading facts stated in that paper, and in the discussion upon it, for comparison with the phenomena of January, 1896; and we shall not quote any values of less than 30·9 inches at sea level :—

					in.
1778.....	Dec.	26th...	London, Royal Society	2 p.m.....	30·918
,, ...	,,	,,	,, Sir G. Shuckburgh ...		30·935
,, ...	,,	,,	Gordon Castle, Banffshire	9 p.m.....	31·007
1808.....	Feb.	24th...	,, ,, ,, ...	11 p.m.....	31·046
1820.....	Jan.	8th...	Kinfauns, Perthshire	11 p.m.....	31·014
,, ...	,,	9th...	,, ,, ...	9 a.m.....	31·056
,, ...	,,	,, ...	Leith	9 a.m.....	31·065
,, ...	,,	,, ...	Hermitage Hill, Leith	9 a.m.....	31·050
1825.....	,,	9th...	Royal Obs , Greenwich	10 a.m.....	30·943
,, ...	,,	,, ...	Mr. Belville, ,, ...		30·958
,, ...	,,	,, ...	Royal Society, Somerset Ho....	9 a.m.....	30·922
,, ...	,,	,, ...	,, ,, ,, ...	3 p.m.....	30·913
,, ...	,,	10th...	,, ,, ,, ...	9 a.m.....	30·914
,, ...	,,	9th...	Kinfauns, Perthshire	9 a.m.....	30·925
,, ...	,,	,, ...	New Malton, Yorks	Max.	30·927
1835.....	,,	2nd...	Mr. Belville, Greenwich		30·908
1882.....	,,	18th...	St. Leonards, Sussex	10.30 a.m...	30·990
,, ...	,,	,, ...	Camden Square, London	10.30 a.m...	30·975
1896.....	,,	9th...	,, ,, ,, ...	9 p.m.....	30·934

From the above it will be seen that as regards the vicinity of London the reading of 30·975 inches on January 18th, 1882, had never before been reached, nor has it on the present occasion, the maximum being 30·934 inches at 9 p.m. on the 9th.

But as regards the British Isles generally, we think that 1896 will be found to have considerably surpassed every instance on record.

The highest in the above table is 31·065 inches at Leith at 9 a.m. on January 9th, 1820; but the *Daily Weather Report* of January 9th, 1896, shows for 8 a.m. 31·06 inches at Stornoway and at Aberdeen, and 31·09 inches at Ardrossan, Ayrshire, and as these are probably not the absolute maximum at those stations, and as probably they are not any one of them in the actual spot where pressure was greatest, we shall not be surprised if next month we have to report an indisputable record of 31·10 inches.

To the Editor of the Meteorological Magazine.

SIR,—The pressure at 9 a.m. on the 9th, corrected and reduced to sea level, was 31·071 inches. This is unprecedented for Edinburgh, where the only records (since 1770 ?) of 30·9 in. or upwards have been:

			in.
1820.....	January 9th	9 a.m.....	31·058
1825.....	,, ,, ...	.....	30·961
1834.....	December 15th.....	.....	30·950
1835.....	January 2nd	.....	30·941
1854.....	March 4th.....	.....	30·902
1896... ..	January 9th	9 a.m.....	31·071

It has therefore been 0·013 in. above any previous record.

Yours very truly,

R. C. MOSSMAN.

10, *Blacket Place, Edinburgh.*

To the Editor of the Meteorological Magazine.

SIR,—I suppose that the sea level pressure here to-day has had no recorded precedent in England; it was exactly 31·000 in. at 8.15 a.m., and rose to, and remained at, 31·021 in. from 1 p.m., till about 1.45 p.m., and even as late as 10 p.m. it was 30·996 in. The above are corrected readings of a verified Fortin Standard.

Yours very truly,

CHARLES L. BROOK.

Harewood Lodge, Meltham, Huddersfield, January 9th.

To the Editor of the Meteorological Magazine.

SIR,—The sea level pressure here at 10.20 a.m. to-day, as shown by a verified Standard by Hicks, was 31·013 inches.

Yours truly,

REGINALD BUSHELL.

Hinderton Lodge, Neston, Cheshire, January 9th.

We have been favoured with several other records, but it would be endless to quote all—and therefore we have inserted only indisputable records exceeding 31 inches.

As far as we have at present ascertained, we believe that the

pressure exceeded 31 inches at every station north of latitude 53° N. An event for which there is no recorded precedent.

We have just heard from Mr. Mossman that at Fort William, Inverness, the pressure at 10 a.m. on the 9th reached 31·098 inches, or within ·002 inches of the 31·10 inches which we suggested on p. 182.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 18th, at the Institute of Civil Engineers, Great George Street, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. R. H. Scott, F.R.S., read a paper on "Some of the Differences between Fogs, as related to the weather systems which accompany them." In this it was shown that there are at least two distinct classes of phenomena described under the generic name of "fog." In the case of anticyclonic fogs, no rainfall takes place, the temperature is low in the morning, and there is a considerable rise of temperature during the day, while in the case of cyclonic fogs rainfall does take place, and the temperature is high in the morning, frequently approaching or even equalling the maximum for the day. Mr. Scott also investigated the cases of several well-marked fogs in London, and found that there was no direct relation traceable between the temperature accompanying them and the death-rate.

Major H. E. Rawson described the results of his analysis of the Greenwich Barometrical Observations from 1879 to 1890, with special reference to the declination of the sun and moon.

A paper by Mr. S. C. Knott was read, giving the results of his meteorological observations taken at Mojanga, Madagascar.

Mr. R. H. Scott also exhibited some specimens of the illustrations for the "International Cloud Atlas," which is now being prepared for publication.

REVIEWS.

Congrès de l'Atmosphère organisé sous les auspices de la Soc. royale de Géographie d'Anvers, 1894. Compte rendu par le Chevalier Le CLEMENT DE S. MARCQ, Capitaine du Génie, Secrétaire général. Backer, Anvers, 1895. Large 8vo., 272 pp.

WE regret having been unable earlier to report upon the meeting at Antwerp in August, 1894, which, we understand, was an extremely pleasant one. But thanks to the kindness of the Secretary, the above excellent report of the business of the meeting places the papers upon record for years to come. As to the hospitality of the city it will not soon be forgotten by those who experienced it. We gave* the programme and some details in advance, and therefore need merely point out how far they were fulfilled.

* *Met. Mag.*, Vol. xxix. (1894), p. 89.

There was an official reception at which the President, Lieut.-Gen. Wauvermans, delivered an address upon the progress of aerostation. Subsequently the work of the two sections went on simultaneously. We cannot report it all, but among the more important subjects were:—

Variation in wind velocity, according to altitude and to geographical position; and on the origin of storms; by M. Plumandon, of the Observatory on the Puy de Dôme.

The wind in squalls; by M. E. Durand-Gréville. (A very interesting and suggestive paper.)

The direction of upper currents as indicated by astronomical observations; by M. Ventosa, of the Madrid Observatory.

On synoptic weather charts; on the nature of wind; and on the force of the wind in Belgium; by M. Lancaster.

Experiments with, and theory of, Helices for balloons; by le Chev. Le Clément de S. Marcq.

Contribution to the bibliography of aerial navigation; by M. A. Wouvermans.

This last article occupies 35 pages and, although (as its author very modestly describes it) only a "Contribution," it is one of great value, which must not be overlooked by anyone who professes to give a complete bibliography.

On the whole, the volume is very interesting and generally useful.

U. S. Department of Agriculture. Weather Bureau. Reports of the Chief of the Weather Bureau, for 1891-92, and for 1893. Government Printing Office, Washington, 1893. 4to., 528 pp., 4 plates, and 1894, 319 pp., 2 plates.

THESE being initial volumes of the U. S. reports under the civil administration, call for brief notice. They are signed by Prof. Harrington the first chief under the new *régime*. The first noticeable feature is the adoption of quarto size, instead of octavo. This is an indisputable improvement, as it enables the matter to be grouped very much in the manner recommended many years since by the International Meteorological Congress.

The list of observing stations is very good, and quite a model of condensed information. A single line of type gives the name of the station, what continuously-recording instruments it possesses, its latitude and longitude, the difference between local time and 75th meridian time, the altitude of the barometer above sea level, the height of the thermometer, rain-gauge, and anemometer above the ground, and the date at which the record commenced. We may mention one feature, which is very satisfactory, and one quite the reverse. We see with pleasure and surprise the large number of recording instruments in use—there are, for instance, 61 stations with Richard's recording barometers. On the other hand, we find that roof stations are almost universal, in fact out of about 171

stations, only 39 have either their thermometer or rain gauge within 6 ft. of the ground. The average height must be quite 50 ft., and 25 of them are over 100 ft. Among the highest are Boston 174 ft., Chicago 238 ft., Cincinnati 145 ft., Detroit 144 ft., New York 155 ft., Philadelphia 166 ft., Portland, Oregon, 196 ft., and San Francisco 154ft.

We thought of comparing the records for New York at 155 ft. with those at the Central Park, which we imagined would be made at or near ground level, but on turning up Dr. Draper's volumes we find that his instruments are also on a roof 53 ft. above sea level.

There seem to be signs of a desire on the part of the authorities to decrease the number of these roof stations, and surely now that the office is under the Department of Agriculture, there ought to be no difficulty in getting observations made under normal conditions. At present we are at a loss to know how American engineers utilize the rainfall records of the Weather Bureau. We learn from the introduction that at most of the volunteer stations the heights are less, but in the long lists of the results from these stations, on pages 367 to 433, no information is given as to the heights of the gauges above ground, or above sea level.

There is an interesting note by Prof. Marvin as to the patterns of instruments mostly employed. Among them is one, Eccard's recording rain-gauge, which appears to be (except that it is arranged to suit a roof exposure) identical with that made by Mr. Apps in about 1864, and described in *Brit. Rain.*, 1878.

The volume for 1893 is, of course, generally similar to the previous one—but there are two special features. In the introduction, there is an engraving and description of the instrument used in the U.S. to record sunshine. It is neither on the Burning nor the Photographic principle which are the two chiefly, if not solely, employed in Europe, but is really a modification of Prof. Leslie's differential thermometer —and is therefore coming very near to the black and bright bulb recording thermometer shown by Marie Davy in the Montsouris Exhibit at the Paris Exposition of 1878, and in a modified form now quoted in the catalogue of MM. Richard Frères. The U.S. pattern works electrically which, in our opinion, is a disadvantage, but of one thing we are certain, namely, that at Washington, or some other station, there should be regularly worked, side by side, all the various modes of recording this element; as, until that is done, no one knows what relation the various records bear one to another.

Another departure from European practice, (the merit of which we doubt) and which is certainly fatal to rigorous comparison, is set out in the following sentences:—

COMPILATION OF SUNSHINE DATA.

"The Automatic records of sunshine obtained from both the thermometric and the photographic records are tabulated in monthly forms, giving hourly amounts of sunshine, from which daily and monthly sums and percentages are calculated. The following extracts

from existing instructions illustrate the manner of compensating for instrumental imperfections :—

TWILIGHT CORRECTIONS—When the sun is just above the horizon, either morning or evening, the intensity of its action is greatly diminished, even with clear skies, so that a portion of early morning and late afternoon sunshine will not generally be recorded; an allowance therefore must be made in order to ascertain more accurately the actual amount of sunshine. For convenience, this allowance will be called the "Twilight Correction." In the forenoon, it will be the difference between the time of sunrise for the latitude of the station (as shown by table of sunrise and sunset) and the local time at which the sunshine record commenced, provided, the sun was not obscured by clouds or thick haze during the period. The afternoon twilight correction, similarly, will be the difference between the actual time of sunset and the time the record of sunshine stops. These corrections will be apportioned between the appropriate hours of early morning and late afternoon.

If the character of sunset is cloudy, the twilight correction will be regarded as zero, but when the observer knows that cloudiness has prevailed but a part of the time, he will employ such a value of twilight correction as will represent, in his judgment, the actual sunshine not recorded."

Part VI. of the volume contains several papers of interest, especially the hourly observations on Pike's Peak, 14,134 feet above sea level. There are also interesting tables of the mortality (on land) by wind, averaging 258 deaths per annum, and by lightning, averaging 196 per annum.

A NEW OBSERVATORY FOR WEST AUSTRALIA.

WE hear from Sir Charles Todd, K.C.M.G., Government Astronomer for South Australia, that the Government of West Australia having decided to establish an observatory at Perth, asked Sir Charles if he would prepare detailed plans and specifications for the proposed observatory and for its equipment. This he has done, and it includes a 6-inch transit circle and an 8-inch equatorial.

An observatory without a director would be useless, and Sir Charles' chief assistant, Mr. Ernest Cooke, M.A., has been appointed.

It is hardly likely that such an establishment, which is to cost about £5,000 for equipment, will do nothing for meteorology—and if it is to be wholly astronomical we do not see why Sir Charles reported it to us—so we hope that, though not a single word is said as to meteorology or meteorological instruments, some good may come of the new Perth Observatory, to which we wish all success.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	82·0	8	47·7	7	72·7	54·6	49·1	63	125·2	43·1	3·42	12	6·0
Malta	103·6	5	64·6	11	87·7	69·7	68·0	61	159·0	59·4	·00	0	1·2
Mauritius	77·3	12	59·0	17*a*	75·2	64·1	61·3	77	125·2	49·2	1·12	9	4·4
Calcutta	92·0	2	75·7	4	88·7	79·0	77·6	83	160·5	74·6	4·53	12	7·9
Bombay	89·0	4	74·6	11	84·7	77·7	76·2	85	135·0	72·2	18·04	28	8·7
Ceylon, Colombo	88·2	29	73·8	21	86·1	77·1	71·4	78	150·5	70·0	·52	5	5·8
Melbourne	63·2	18	33·3	5	54·7	40·3	39·9	75	112·2	24·2	1·78	14	6·5
Adelaide	65·9	17	37·1	25	57·9	43·5	43·5	77	120·7	30·1	4·48	20	6·5
Sydney	66·8	15	36·8	9	57·6	41·9	37·7	76	112·0	24·6	·35	8	1·9
Wellington	57·3	16	32·0	13*b*	51·2	38·3	36·5	73	105·0	20·0	4·35	17	4·7
Auckland	58·0	19	37·0	21	54·4	42·6	39·1	71	114·0	32·0	6·65	25	5·8
Jamaica, Kingston	92·8	25	71·4	12	89·8	73·3	69·8	71	...	...	·51	5	2·8
Trinidad	92·0	6	68·0	*c*	88·7	69·7	70·5	75	169·0	65·0	2·57	16	...
Grenada	84·8	31	71·0	21	83·1	74·3	69·9	73	146·2	...	7·89	23	4·6
Toronto	90·0	7	49·1	11	76·3	56·3	54·2	67	105·2	43·2	2·49	13	6·2
New Brunswick, Fredericton	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	86·3	2	41·3	8	75·8	51·7	...	...	...	...	3·30	14	6·0
British Columbia, Esquimalt	79·2	10	42·7	2	69·3	50·0	55·4	88	...	...	·12	6	4·9

a—and 19; *b*—and 26; *c*—various.

Remarks.

Malta.—Adopted mean temp. 78°·6, 1°·3 above the average. Mean hourly velocity of wind 6·8 miles. Temp. of sea rose to 82°·5. Lightning on the 6th. J. F. Dobson.

Mauritius.—Mean temp. of air 0°·6 above, of dew point 1°·8 above, and rainfall 1·20 in. below, their respective averages. Mean hourly velocity of wind 10·0 miles, or 1·8 miles below average; extremes, 25·9 on 23rd, and 1·7 on 2nd, 6th and 7th; prevailing direction, E.S.E. C. Meldrum, F.R.S.

Adelaide.—Mean temp. 0°·9 below the average of 38 years. Rainfall very heavy, 1·84 in. above the average. The rains were very general but rather light in the north, heavy over the southern portion of the colony. C. Todd, F.R.S.

Sydney.—Mean temp. 2°·7 below, and rainfall 4·05 in. below, their respective averages. H. C. Russell, F.R.S.

Wellington.—Total rainfall under the average, although it was very showery during the latter part of the month. Variable winds, and on the whole moderate, and frequent calms; generally cold weather. Hail on 4 days. Fog on 3 days. Earthquake on 17th. R. B. Gore.

Auckland.—An unusually cold, wet and stormy month. Rainfall two inches above the average of 28 years. Mean temp. 3°·8 below the average; barometrical pressure unusually low during most of the month. T. F. Cheeseman.

Jamaica, Kingston.—Mean hourly velocity of wind 4·8 miles. Fair in Kingston, with a fourth of the average fall of rain. R. Johnstone.

Trinidad.—Rainfall 6·88 in. below the average of 30 years. J. H. Hart.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1895.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	81·3	21	46·0	25	72·2	54·2	53·4	75	123·8	41·0	3·09	18	5·8
Malta	91·9	1	61·4	26	87·1	68·8	67·6	70	144·6	...	·37	1	1·7
Mauritius	77·3	5	59·9	5	74·6	64·6	60·7	76	125·0	46·9	4·66	21	5·7
Calcutta	91·0	11	74·0	19	87·1	77·9	77·4	87	158·5	72·9	11·84	20	8·4
Bombay	86·4	18	74·0	30	83·9	76·7	75·4	85	133·8	71·8	15·97	28	8·6
Ceylon, Colombo	89·2	10	75·4	9	87·4	78·2	72·2	76	150·5	72·0	·92	11	5·7
Melbourne	72·9	24	34·9	8	60·5	45·8	44·6	73	120·5	26·5	1·81	17	6·5
Adelaide	73·2	17	38·8	15	63·7	47·1	45·9	70	133·1	31·3	2·42	20	6·6
Sydney	76·0	24	40·6	30	64·3	49·4	43·7	71	122·0	27·7	·42	11	4·1
Wellington	62·1	26	34·0	8	53·1	42·7	39·4	74	115·0	23·0	3·26	16	4·8
Auckland	68·2	29	37·0	3	56·4	44·1	40·7	70	118·0	32·0	1·63	15	5·0
Jamaica, Kingston	94·6	17	70·4	20	89·9	73·3	70·7	76	..	...	2·39	9	3·2
Trinidad	93·0	3	68·0	3*a*	89·3	70·6	72·8	76	178·0	67·0	4·86	20	...
Grenada	86·8	19	72·6	6	84·1	75·6	70·0	74	153·6	...	6·08	26	4·7
Toronto	84·0	12	43·2	22	75·6	56·2	56·2	75	99·5	37·3	3·02	13	4·6
New Brunswick, Fredericton	...	...	...	...	...	...	...	...	...	...	...	...	...
Manitoba, Winnipeg	88·3	15	32·8	20	74·8	48·1	...	...	...	...	1·01	13	5·3
British Colombia, Esquimalt	77·7	28	43·2	13	67·4	49·2	54·2	90	...	...	·45	3	5·7

a—and 10, 17

REMARKS.

MALTA.—Adopted mean temp. 77°·6, 0°·6 below the average; mean hourly velocity of wind 6·3 miles Average temp of sea, 80°·0. Lightning was seen on 4 days.
J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·2 above, of dew point 1°·4 above, and rainfall 2·38 in. above, their respective averages. Mean hourly velocity of wind 13·1 miles, or 0·8 mile below average; extremes, 35·5 on 24th and 2·0 on 2nd, 3rd and 22nd; prevailing direction E.S.E. Thunder and lightning on 13th. The wettest August in 21 years. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Lightning was seen on 5 days. D. G. MANTELL.

Adelaide.—Mean temp. 1°·4 above, and rainfall ·05 in. above, the average.
C. TODD, F.R.S.

Sydney.—Mean temp. 1°·9 above, humidity 2 below, and rainfall 2·43 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—On the whole showery, with intervals of fine weather. Prevailing wind N.W., strong on nine days. Thunder and lightning on 24th; hail on 5 days. Rainfall 1·94 in. below, and mean temp. 0°·1 below, the average. Earthquakes on 17th and 21st. R. B. GORE.

Auckland.—An unusually dry and cool month, the rainfall being little more than one-third of, and the mean temp. 2°·2 below, the average. Barometrical pressure unusually high. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 4·3 miles. Rainfall half the average. Sharp thunderstorm on 23rd for about 5 hours. R. JOHNSTONE.

TRINIDAD.—Rainfall 5·43 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1895.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall .	3·21	XI.	Lake Vyrnwy	5·59
,,	Birchington, Thor	2·22	,,	Corwen, Rhug	3·19
,,	Hailsham	3·28	,,	Carnarvon, Cocksidia ...	2·98
,,	Ryde, Thornbrough	3·87	,,	I. of Man, Douglas	3·73
,,	Emsworth, Redlands ...	3·17	XII.	Stoneykirk, Ardwell Ho.	3 06
,,	Alton, Ashdell	3·07	,,	New Galloway, Glenlee	6·98
III.	Oxford, Magdalen Col..	1·92	,,	Melrose, Abbey Gate...	...
,,	Banbury, Bloxham	2·18	XIII.	N. Esk Res. [Penicuick]	4·80
,,	Northampton, Sedgebrook	1·71	,,	Edinburgh, Blacket Pl..	2·27
,,	Alconbury	1·78	XIV.	Glasgow, Queen's Park..	4·49
,,	Wisbech, Bank House...	1·76	XV.	Inverary, Newtown	8·62
IV.	Southend	2·70	,,	Islay, Gruinart Schools..	6·06
,,	Harlow, Sheering..... ...	1·90	XVI.	Dollar.....	5 09
,,	Colchester, Lexden	2·40	,,	Balquhidder, Stronvar...	9·10
,,	Rendlesham Hall	1·35	,,	Balliniuig	5·13
,,	Diss	2·46	,,	Dalnaspidal H.R.S.....	8·11
,,	Swaffham	1·91	XVII.	Keith H.R.S.....	5·05
V.	Salisbury, Alderbury ...	2·05	,,	Forres H.R.S.	2·50
,,	Bishop's Cannings	2·80	XVIII.	Fearn, Lower Pitkerrie..	2·30
,,	Blandford, Whatcombe .	3·47	,,	Loch Shiel, Glenaladale	8·91
,,	Ashburton, Holne Vic...	6·17	,,	N. Uist, Loch Maddy ...	4·41
,,	Okehampton, Oaklands.	7·26	,,	Invergarry	7·68
,,	Hartland Abbey	5·45	,,	Aviemore H.R.S.	3·36
,,	Lynmouth, Glenthorne.	5·62	,,	Loch Ness, Drumnadrochit	3·91
,,	Probus, Lamellyn	7·35	XIX.	Invershin	1·88
,,	Wellington, Sunnyside..	...	,,	Scourie	3·17
,,	Wincanton, Stowell Rec.	2·69	,,	Watten H.R.S.....	3·94
VI.	Clifton, Pembroke Road	2·94	XX.	Dunmanway, Coolkelure	12·85
,,	Ross, The Graig	2·13	,,	Fermoy Gas Works	...
,,	Wem, Clive Vicarage ...	1·67	,,	Killarney, Woodlawn ...	9·42
,,	Cheadle, The Heath Ho.	2·75	,,	Caher, Duneske	5·49
,,	Worcester, Diglis Lock	1·53	,,	Ballingarry, Hazelfort...	3·65
,,	Coventry, Coundon	2·13	,,	Limerick, Kilcornan ...	...
VII.	Ketton Hall [Stamford]	1·58	,,	Ennis	4·30
,,	Grantham, Stainby	1·70	,,	Miltown Malbay	...
,,	Horncastle, Bucknall ...	1·92	XXI.	Gorey, Courtown House	4·84
,,	Worksop, Hodsock Priory	2·12	,,	Athlone, Twyford	3·76
VIII.	Neston, Hinderton	2·26	,,	Mullingar, Belvedere ...	4·60
,,	Preston, Haighton	3·87	,,	Longford, Currygrane...	4·11
,,	Broughton-in-Furness ...	7·07	XXII.	Woodlawn	5·06
IX.	Ripon, Mickley.....	2·87	,,	Crossmolina, Enniscoe ..	6·13
,,	Melmerby, Baldersby ...	2·18	,,	Collooney, Markree Obs.	4·66
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	...
,,	Middleton, Mickleton ...	3·47	XXIII.	Lough Sheelin, Arley...	3·98
X.	Haltwhistle, Unthank...	3·44	,,	Warrenpoint.....	3·93
,,	Bamburgh	1·93	,,	Seaforde..	3·73
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	4·99
XI.	Llanfrechfa Grange	4·48	,,	Bushmills, Dundarave..	5·13
,,	Llandovery	4·13	,,	Stewartstown	4·38
,,	Castle Malgwyn	2·97	,,	Buncrana	4·01
,,	Builth, Abergwessin Vic.	6·84	,,	Longe Swilly, Carrablagh.	5·94
,,	Rhayader, Nantgwillt ...	5·68			

DECEMBER, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·19	+ ·12	·34	14	16	56·4	5	26·1	22	8	19
II.		Maidstone (Hunton Court)...	1·72	— ·52	·98	16	6	...	...	...	...	...	...
,,		Strathfield Turgiss	2·28	+ ·27	·38	14	21	56·0	5	20·4	11	14	22
III.		Hitchin	1·79	— ·24	·38	14	17	54·0	5, 30	21·0	21	15	...
,,		Winslow (Addington)	1·85	— ·60	·40	14	17	53·0	5, 30	22·0	22	15	23
IV.		Bury St. Edmunds (Westley)	1·97	— ·27	·51	14	13	56·0	6	26·0	22	...	...
,,		Norwich (Brundall)	1·80	...	·28	12*a*	20	56·4	5	26·4	22	10	25
V.		Weymouth (Langton Herring)	4·63	+ 1·53	1·09	17	20	55·0	5	30·0	20*f*	5	...
,,		Torquay (Cary Green)	5·65	...	·90	23	25	54·4	5	30·5	21	2	8
,,		Polapit Tamar [Launceston]..	4·80	+ ·57	·96	5	28	54·7	30*b*	21·7	21	3	8
VI.		Stroud (Upfield)	2·05	— ·40	·40	14	20	52·0	5, 30	28·0	7*g*	15	...
,,		Church Stretton (Woolstaston)	2·56	— ·49	·52	12	21	53·0	5	25·0	21	17	23
,,		Tenbury (Orleton)	2·08	— ·29	·51	12	15	56·8	5	24·0	11	10	19
VII.		Leicester (Barkby)	2·26	+ ·12	·46	12	18	55·0	5, 30	16·0	21	22	26
,,		Boston	1·58	— ·27	·40	12	10	50·0	30	24·0	22	20	...
,,		Hesley Hall [Tickhill].....	2·09	+ ·11	·40	12	13	55·0	4	23·0	22	19	...
VIII.		Manchester (Plymouth Grove)	3·69	+ ·25	·70	12	17	54·0	7, 12	25·0	21	11	12
IX.		Wetherby (Ribston Hall) ..	1·50	— ·94	·42	5	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·93	+ ·12	2·15	4	21	..	...	...	...	...	...
,,		Hull (Pearson Park).	2·37	+ ·10	·40	28	13	55·0	5	27·0	8, 22	18	19
X.		Newcastle (Town Moor)	1·42	— ·88	·30	28	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	14·15	— ·66	4·02	4	20	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·57	+ ·02	·67	15	25	...	...	...	...	...	...
,,		Haverfordwest	3·96	— 1·03	·44	23	28	54·4	5	23·0	21	7	14
,,		Aberystwith (Gogerddan) ...	5·58	+ ·70	·78	14	21	50·0	4*c*	16·0	20	15	...
,,		Llandudno.....	2·33	— ·63	·32	12	21	54·0	5	28·5	21	...	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·10	+ 1·08	·92	4	14	51·6	5	23·4	21	12	...
,,		Jedburgh (Sunnyside).....	1·58	— ·62	·34	30	13	47·0	9	26·0	23	12	...
XIV.		Colmonell	5·11	...	·78	12	21	57·0	1	21·0	20	13	...
XV.		Lochgilphead (Kilmory).....	7·58	+ ·21	·84	4	22	...	...	24·0	21	10	...
,,		Mull (Quinish).....	5·81	— 1·76	·79	28	18	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·10	+ ·79	1·10	5	16	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·10	+ 1·02	·50	28	22	53·2	5	24·1	21	13	...
XVII.		Braemar	4·44	+ 1·97	1·31	16	22	47·3	5	12·4	21	23	29
,,		Aberdeen (Cranford)	4·65	...	1·16	12	24	50·0	4, 5	25·0	20*f*	13	...
XVIII		Strathconan [Beauly]	7·32	+ 1·55	1·80	4	13	...	...	...	...	...	...
,,		Glencarron Lodge.....	7·76	...	1·79	4	19	49·5	14	24·0	20	14	...
,,		Cawdor [Nairn]	3·22	+ ·76	·71	4	17	...	...	...	...	...	...
XIX.		Dunrobin	3·01	+ ·36	·50	12	16	49·0	4	26·0	22	13	...
,,		S. Ronaldsay (Roeberry).....	5·91	+ 2·25	2·15	12	29	48·0	3	29·0	6	7	...
XX.	IRELAND.	Darrynane Abbey.....	6·05	...	1·06	23	26	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	6·20	+ 2·56	1·27	22	24	57·0	4, 5	27·0	8*f*	7	...
,,		O'Briensbridge (Ross)	3·67	...	·43	15	24	..	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	4·75	+ 1·63	·98	22	25	...	..	...	..	...	...
,,		Dublin (Fitz William Square)	3·94	+ 1·78	·86	24	27	56·0	30	25·3	21	4	10
XXII.		Ballinasloe	3·81	+ ·39	·58	11	28	51·0	29*d*	22·0	21	16	...
,,		Clifden (Kylemore)	9·75	...	1·29	23	26	...	...	...	...	...	...
XXIII		Waringstown	3·31	+ ·27	·58	29	24	52·0	29	20·0	21	19	24
,,		Londonderry (Creggan Res.).	5·06	+ ·85	·73	12	25	...	...	...	...	...	...
,,		*Omagh* (Edenfel)	5·16	+ 1·48	·73	29	21	50·0	14*e*	19·0	20	13	21

+*Shows that the fall was above the average*; —*that it was below it.*

—*and 14.* *b*—and 31. *c*—and 5, 29. *d*—and 30. *e*—and 29, 30. *f*—and 21. *g*—and 20, 21

METEOROLOGICAL NOTES ON DECEMBER, 1895.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month commenced with unsettled and stormy weather, with rapid and considerable changes, and during the greater part of the month, and especially towards the close, it was very dull and gloomy, with many wet days, but little R. Gales on 3rd, 4th, 12th and 13th.

ADDINGTON.—December was not marked by any particular feature. A moderate quantity of R; occasional frosts of no great severity; a little S; very little fog, but generally dull weather.

BURY ST. EDMUNDS, WESTLEY.—A rough, windy, and mild month. L at night on 6th; S on 27th.

NORWICH, BRUNDALL.—A stormy, unsettled month, with gales at times. The rainfall half an inch under, and mean temp. slightly above, the average. Very dark, damp weather at the close. Terrific gale on 5th, gales on 12th, 13th, 24th, 25th, and 26th. L in N.E. on 6th; slight S on 7th.

WEYMOUTH, LANGTON HERRING.—On the whole a mild, unsettled, wet month, the mean temp. 2° above the average of 23 years. Very high winds from the 5th to the 7th, and also from the 23rd to the 25th, inclusive. Dense fogs on the 29th and 30th. Mean 9 a.m. temp. 41°·6.

TORQUAY, CARY GREEN.—R 2·50 in. above the average. Mean temp. 44°·2, or 1°·3 above the average. Duration of sunshine 26 hours 25 minutes, being 27 hours 5 minutes below the average; 15 sunless days.

POLAPIT TAMAR [LAUNCESTON].—A very wet month. N.N.W. gale on 6th; S.E. gale at night on 23rd. Warm, calm, and summerlike on 31st.

STROUD, UPFIELD.—N.W. gale in the evening on 6th; storm of H and R at 4 p.m. on the 11th; a few flakes of S on 19th.

WOOLSTASTON.—A cold and stormy month. A sharp spell of frost set in on the 6th, and continued till the 29th, S falling on five days. Mean temp. 37°·4. Gales on the 4th, 5th, and 12th.

TENBURY, ORLETON.—A fairly warm dry month, with a mean temp. about the average, and very little frost, the ther. in the screen falling below 30° on only four nights. S on the 6th, 18th, 24th, and 26th; T on the 12th. The last half of the month was singularly cheerless, neither sun, moon, nor stars being visible for days together.

LEICESTER, BARKBY.—A very mild and windy month. Mean temp. 37°·3.

MANCHESTER, PLYMOUTH GROVE.—Great storm of wind and R on the 6th; dense fog on the 20th and 21st. Fine winterly weather on 22nd, 23rd, 27th and 28th. Thick fog on the 31st, but mild as May. Mean temp. 44°·1.

SEATHWAITE.—Heavy R on 4th, 4·02 in.; S two inches deep at 9 a.m. on 7th, and one and a half inches deep on 25th. Fog on 2nd, 9th, 14th and 29th. H on 6th.

WALES.

HAVERFORDWEST.—Except on the 7th and 20th, R or S fell on every day throughout the month, but no heavy fall at any time. The general character of the whole month was mildness and storm, with unusual dampness of the air. It was cold for a day or two about the 7th, followed by mild, damp, foggy weather, which continued up to the 17th. A cold period again occurred between that date and the 27th, sharp frost occurring on five nights, winding up with a S storm, which covered the high and low lands, accompanied by a violent gale from the east. It lasted fully four days. Prevailing winds S.S.W., S.E., E., and N.N.W.

ABERYSTWITH, GOGERDDAN.—Very stormy throughout the month. Very strong gales on 24th, 25th, and 26th from S.E. The last three days very mild.

SCOTLAND.

CARGEN [DUMFRIES].—The feature of the month was the remarkable absence of sunshine, the number of hours being only 25 against an average of 54. In the ten years 1860-69, the average number of hours of sunshine in December was 66; in 1870-79, was 59; in 1880-89, 43; while in the six years 1890-95 it was only 40 hours. Light winds, mostly easterly, prevailed, and the mean temp. is 1°·4 below the average. T on 5th and 6th, S showers on 6th and 28th.

JEDBURGH.—The weather was foggy with little or no wind till the 28th. Frosts occurred, but not for more than a day at a time.

COLMONELL.—Rainfall ·16 in. above average of 19 years. S on 28th.

S. RONALDSAY, ROEBERRY.—A very wet, cold and windy month. The wettest December since 1872. Mean temp. 38°·5.

IRELAND.

DARRYNANE ABBEY.—A wet but very mild month. The last few days foggy, but mild as April. Frost on 19th and 20th.

WATERFORD, BROOK LODGE.—H showers on 6th. Dense fog on 19th and 20th. Heavy gale from S.E. on 22nd. S on 26th.

O'BRIEN'S BRIDGE, ROSS.—Rainfall moderate for the season, in no case amounting to ·50 in. in 24 hours, but very constant, with storms from S.E. to S.W. up to 27th. Very calm with high temp. at the close.

DUBLIN.—A gloomy, wet, stormy and generally inclement month. Fog also was often observed. Christmas week is memorable for a long continued south-easterly gale. Mean temp. 41°·6, 0°·3 above the average. Lunar halos were seen on 30th and 31st; solar halo on the 31st. High winds were noted on 15 days, and attained the force of a gale on seven. Foggy on 10 days. S or sleet on 8 days, H on 3 days, T was heard on the 12th, L seen on the 15th. Faint Aurora on the 7th.

BALLINASLOE.—S on 6th, 7th, 12th and 26th. Gales on 15th, 22nd, 23rd, 24th and 25th. Fog on 17th, 19th and 20th.

OMAGH, EDENFEL.—The first half of the month was persistently wet and unsettled, reaching to a strong gale on the night of the 4th. From the 18th to nearly the end a spell of strong easterly weather, more characteristic of February, prevailed, culminating in a steady gale on the 23rd, 24th and 25th of almost unvarying force, with a comparatively high and absolutely steady barometer and occasional downpours of rain. Although cold snaps were frequent they only lasted a few hours, and there was but little snow.

END OF VOL. XXX.

HINTS FOR OBSERVING AN EARTHQUAKE.

I.—General Remarks.

1. — All notes should be made as soon as possible after the shock is over.

2.—Nothing about which the observer feels the least doubt should be entered without some word or note to indicate its uncertain or approximate character.

3.—In writing his description, the observer may find it useful to place himself in the same position as that in which he felt the shock.

4.—A negative answer to a question is often as useful as an affirmative one or a full description.

5.—Especially is this the case when the shock is not felt or the sound not heard. Such information, especially if it is the experience of several or many persons, may be of great service in determining the boundaries of the disturbed area and the sound-area.

6.—If all or many of the questions cannot be answered, most useful information may still be given by answers to those numbered 1, 3, 6 and 7 (*a*), especially at places where the shock was not strongly felt. Next in importance to these are numbers 4 (*a*), (*c*), (*d*), and 7 (*b*), (*c*), (*d*), (*g*).

7.—If more than one shock is felt, the descriptions of the different shocks should be kept separate. It is just as important to describe slight shocks fully and accurately as those which are stronger and more striking.

8.—Skill in observing earthquakes may be gained by the close observation and description of other transitory phenomena, *e. g.*, a railway train passing near at hand, a peal of thunder, the firing of heavy guns or blastings.

II.—List of Questions.

1.—*Name of the Place* where the earthquake was observed.

2.—*Situation of the Observer:* (*a*) Whether indoors (and on which floor of the house) or in open air? (*b*) How occupied at the moment of the shock?

3.—*Time* at which the shock was felt?

4.—*Nature of the Shock:* (*a*) Was any tremulous motion felt before the principal vibrations, and for how many seconds? (*b*) How many principal vibrations were felt, and for how many seconds did they last? (*c*) Was any tremulous motion felt after the principal vibrations, and for how many seconds? (*d*) Did the shock gradually increase in intensity and then gradually die away, or were there two or more maxima or series of vibrations: and, if so, how many were there, what were the intervals between them, and what was the order of their intensity? (*e*) Were the principal vibrations strongest near the beginning, middle or end?

(*f*) Was any vertical motion perceptible, and, if so, was the movement first upward and then downward, or *vice versâ*?

5.—*Duration of the Shock* in seconds, not including that of the accompanying sound.

6.—*Intensity of the Shock:* Was it strong enough (*a*) to make windows, doors, fire-irons, etc., rattle; (*b*) to cause the chair or bed on which the observer was resting to be perceptibly raised or moved; (*c*) to make chandeliers, pictures, etc., swing, or to stop clocks; (*d*) to overthrow ornaments, vases, etc., or cause plaster to fall from the ceiling; (*e*) to throw down chimneys or make cracks in walls of buildings?

7.—*Sound-phenomena:* (*a*) Was any unusual rumbling sound heard at the time of the shock, and, if so, what did it resemble? (*b*) Did the beginning of the sound precede, coincide with or follow the beginning of the shock, and by how many seconds? (*c*) Did the end of the sound precede, coincide with or follow the end of the shock, and by how many seconds? (*d*) Did the sound entirely precede the shock, and, if so, what was the length in seconds of the interval between the end of the sound and the beginning of the shock? (*e*) Did the sound become gradually louder and then die away, or were there several maxima of intensity? (*f*) Did the sound change in character at or about the time when the strongest vibrations were felt? (*g*) Was the sound loudest before, at, or after the instant when the shock was strongest? (*h*) Could any estimate be formed of the intensity of the sound when loudest by comparison with that of some well-known sound at a given distance?

III.—Remarks on the Preceding Questions.

3.—*Time of Occurrence:* (*a*) The time recorded should be that of the instant when the shock was strongest; or, if no shock was felt, of the instant when the sound was loudest. (*b*) Immediately after the earthquake is over, the time should be taken, and the interval between the instant when it was strongest and the time of looking at the watch estimated. (*c*) The day, hour, minute, and, if possible, the second should be noted. If the seconds hand cannot be trusted, the fraction of a minute (say, to the nearest tenth) should be given instead. (*d*) As soon afterwards as possible, the watch should be compared with a chronometer regulated every day from Greenwich. If the watch is not a good one, or if its rate of error is unknown, another comparison should be made after a short interval (say, at about the same time next day). The correct time of occurrence should then be calculated. (*e*) If the time of occurrence cannot be obtained accurately, it should still be entered, if only for the sake of identifying the shock.

4.—*Nature of the Shock:* (*a*) The whole perceptible movement may be divided for convenience into two kinds: the tremulous motion and the principal vibrations. The tremulous *motion* may be taken as that during which it is not possible to *distinguish* the separate vibrations or to count their number: the

principal vibrations when it is possible to do so. As a rule, British earthquakes begin with a tremulous motion, which changes, perhaps rapidly, into the principal vibrations, and die away with a tremulous motion. Sometimes nothing but the tremulous motion is felt, and occasionally there is no perceptible movement at all, but only the earthquake sound. (*b*) If there are two or more series of principal vibrations, their number and relative intensity should be noted, the lengths of the intervals between them, and whether during these intervals the tremulous motion and sound entirely ceased.

5.—*Duration:* (*a*) It is hardly worth while attempting to measure the duration with the aid of a watch, for the time can generally be more usefully employed. (*b*) Estimates of the duration, however, unless checked, are nearly always in excess of the true amount. In estimating the duration of the shock or of the several parts, the observer should imagine the earthquake repeated, marking the beginning and end of each part or of the whole, the aid of another person being obtained to measure with a watch the intervals thus indicated. This should be done two or three times.

6.—*Intensity:* (*a*) The different parts of question 6 correspond to degrees 4 to 8 respectively of the Rossi-Forel scale of seismic intensity. (*b*) When any part of the question can be answered in the affirmative, the answer should be given in full: *e.g.*, it should be stated whether doors, windows, fire-irons, etc., all rattled, or doors only, etc.; and, if windows only, whether they are sash or French windows. (*c*) It is desirable that answers should be given, especially if negative, to all parts of question 6. (*d*) The value of the description will be increased by a curve showing roughly the relation between the intensity and the time.

7.—*Sound-phenomena:* (*a*) The sound which accompanies earthquakes can generally be recognised as quite distinct from the noises made by the rattling of loose objects. It is difficult to describe exactly as it does not resemble closely any ordinary sound, but it is often compared to thunder (especially distant thunder), the passage of a traction-engine or heavy vehicle, the dragging of furniture across the floor of a room overhead, the firing of cannon, the roaring of a chimney on fire, or the rush of a gust of wind; occasionally it is short and abrupt like that caused by the fall of a heavy body or the slamming of a door. (*b*) The time-relations of the sound and shock, questions 7 (*b*), (*c*), (*d*), (*g*), are of great importance and should be closely observed. The word "shock" is used to denote the entire perceptible motion, including both the tremulous motion and the principal vibrations.

IV.—Order in which the Observations should be Made and Recorded.

1.—While the earthquake lasts the whole attention should be given to observing the nature of the shock and sound, and their relations to one another, the variations in intensity and character of each.

2.—Immediately the earthquake is over, take the time (in the

following order: fraction of a minute or second, minute, hour) and estimate the interval between the instant when the shock was strongest and the instant of taking the time (question 3).

3.—Write notes on the nature of the shock and sound, and their relations to one another (questions 4 and 7).

4.—Estimate the duration of the shock and sound, and the intervals between the beginning of each and the end of each (questions 5 and 7).

5.—Record the intensity (question 6).

6.—Write notes about the position and occupation at the time of the earthquake (question 2).

V.—Concluding Remarks.

Having been engaged for several years in studying and cataloguing the earthquakes of Great Britain, I should be very grateful for any assistance that may render the list of shocks more complete or the account of any particular shock more detailed. Most valuable and welcome help could be given by sending me: (1) Early notice of the occurrence of any earthquake, or suspected earthquake, whether perceived by the writer himself or not; (2) The names and dates of any newspapers in which accounts of the shock are given; (3) A description of the earthquake, as careful and complete as can be made, whether observed by the writer himself or by another on whose accuracy he can depend; (4) The names and addresses of any persons within or near the disturbed area, who, it is thought, might be able and willing to communicate some account, if applied to; (5) Descriptions of the earthquake written by other observers.

I make this last suggestion (5) with much diffidence; but I do so simply from having had frequent experience of valuable and kindly help being voluntarily given in this way during my investigations of recent earthquakes. A person on the spot has several advantages, partly from his more intimate knowledge of the district and its inhabitants, partly because a little intelligent cross-examination will generally extract far more than the most carefully framed set of questions. If any reader of these notes should feel disposed, after the occurrence of any earthquake, to give this almost invaluable help, I shall be happy to send printed forms containing the questions given above. I would also suggest that, if more complete descriptions are not obtainable, information of the most serviceable kind would be supplied by answers (which may be conveniently given in tabular form) to the questions numbered 1, 3, 6, and 7 (*a*). The time of occurrence in these cases, it should be mentioned, is only required to identify the shock, and, unless there is more than one, need not be very accurately determined. It is important to remark that the records of each observer, kept separately, are of far greater value than an average description founded on all the different records.

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